



Earth Resources
A Continuing
Bibliography
with Indexes

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January 1985

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CONTINUING BIBLIOGRAPHY WITH INDEXES

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STAR (N-10000 Series) N84-28726 - N84-35284

IAA (A-10000 Series) A84-39763 - A84-49697

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 44

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between October 1 and December 31, 1984 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch 1985
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INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the Earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the Earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 579 reports, articles, and other documents announced between October 1 and December 31, 1984 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations include the original accession numbers from the respective announcement journals.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

- IAA* entries identified by accession number series A84-10,000 in ascending accession number order;

- STAR* entries identified by accession number series N84-10,000 in ascending accession number order.

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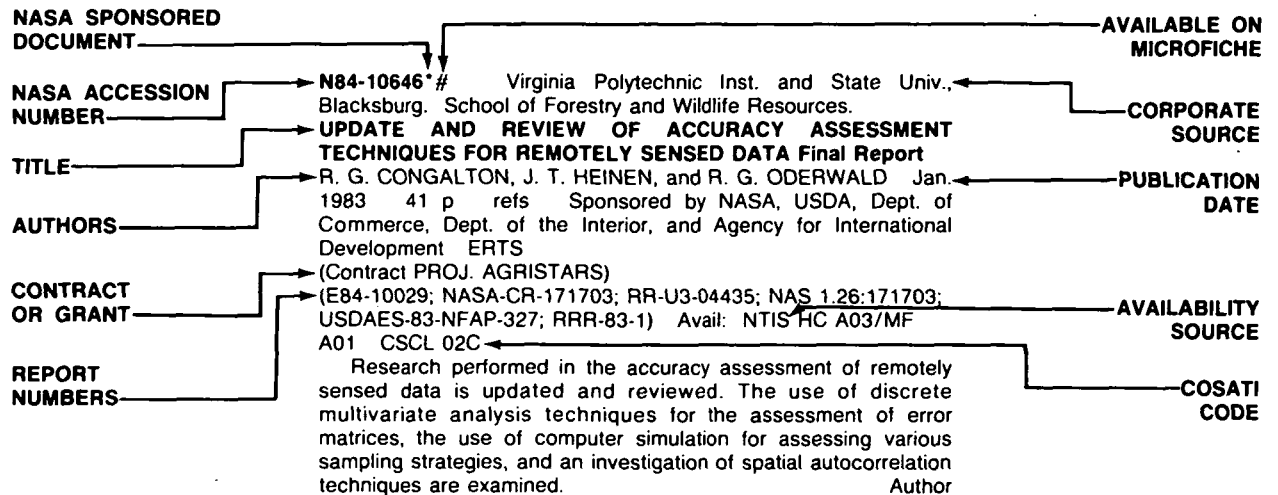
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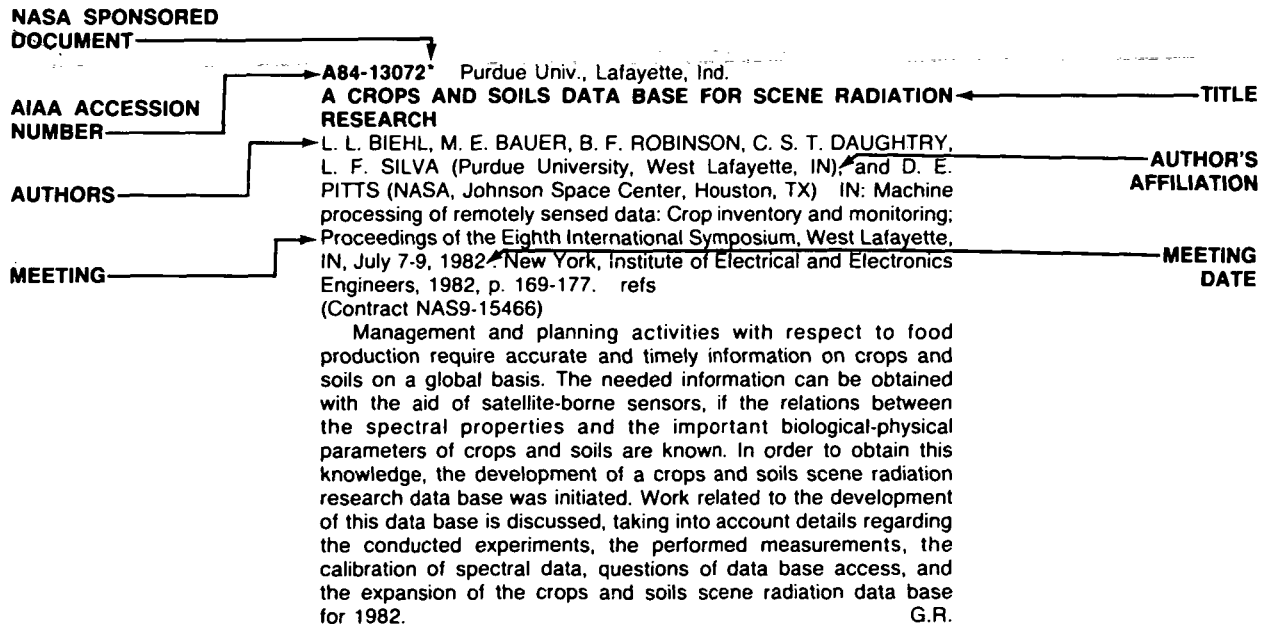
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EARTH RESOURCES

A Continuing Bibliography (Issue 44)

JANUARY 1985

01

AGRICULTURE AND FORESTRY

Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

A84-39938*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DETERMINING SOIL MOISTURE FROM GEOSYNCHRONOUS SATELLITE INFRARED DATA - A FEASIBILITY STUDY

P. J. WETZEL, D. ATLAS (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD), and R. H. WOODWARD (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt; General Software Corp., Landover, MD) *Journal of Climate and Applied Meteorology* (ISSN 0733-3021), vol. 23, March 1984, p. 375-391. refs

Numerical modelling results are reported from a pilot study investigating the feasibility of developing a technique for daily soil moisture measurement throughout the world, based on GOES infrared data. A detailed one-dimensional boundary layer-surface-soil model was used in order to determine which physical parameters observable from GOES are most sensitive to soil moisture, and which are most effected by seasonal changes, atmospheric effects and vegetation cover. The results of the sensitivity test show that the mid-morning differential of surface temperature with respect to absorbed solar radiation is optimally sensitive to soil moisture. A case study comparing model results with GOES infrared data confirms the sensitivity of this parameter to soil moisture and also confirms the applicability of the model to predicting area-averaged surface temperature changes. Model measurements of soil moisture are expected to be most accurate for dry or marginal agricultural areas where drought is common. Sources of error, including the advection of clouds, are examined and methods of minimizing error are discussed. I.H.

A84-39947 GLOBAL VEGETATION INDICES FROM THE NOAA-7 METEOROLOGICAL SATELLITE

J. D. TARPLEY, S. R. SCHNEIDER, and R. L. MONEY (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) *Journal of Climate and Applied Meteorology* (ISSN 0733-3021), vol. 23, March 1984, p. 491-494. refs

Northern and Southern Hemisphere polar stereographic maps of 'vegetation index' are now being produced by the National Oceanic and Atmospheric Administration. The maps are derived from visible and near-infrared data from NOAA's operational polar orbiting satellites. The data are composited over a weekly period to minimize cloud and scan angle effects. The mapped images are being made available to the public in both image and tape format, on a regular schedule. Author

A84-40156#

APPLICATIONS OF SATELLITE REMOTE SENSING FOR U.S. CROP ACREAGE ESTIMATION, 1980-81 RESULTS

J. W. MERGERSON, G. A. HANUSCHAK, and P. W. COOK (U.S. Department of Agriculture, Statistical Research Div., Washington, DC) IN: *Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1*. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 59-70. refs

A84-40157*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

RESEARCH IN SATELLITE-AIDED CROP FORECASTING

J. D. ERICKSON, J. L. DRAGG, R. M. BIZZELL, and M. C. TRICHEL (NASA, Johnson Space Center, Houston, TX) IN: *Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1*. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 77-86. refs

Evaluations of remote sensing procedures developed specifically to estimate non-U.S. spring small grains area show accuracies of less than 10 percent relative difference to reference statistics for North Dakota in 1978 and good comparison with 9000 square miles of observations over four states and Saskatchewan, Canada during the years 1976-79. Processing a 5 x 6-nautical-mile sample site requires a few minutes manual time and a few minutes central processing unit time on an AS-3000 computer. Evaluations of summer crop, corn, and soybeans area estimates show unbiased summer crops estimates in the U.S. central corn belt but significant bias in one of two years for area estimates of corn and soybeans. Based on results to date, a highly automated corn/sorghum/soybean area estimation procedure should be achieved that is applicable to Argentina. Author

A84-40158#

SOIL LOSS PREDICTION IN A GEOGRAPHIC INFORMATION SYSTEM FORMAT

M. A. SPANNER (Technicolor Government Services, Inc., Moffett Field, CA), A. H. STRAHLER (Hunter College, New York, NY), and J. E. ESTES (California, University, Santa Barbara, CA) (Environmental Research Institute of Michigan, NOAA, NASA, et al., *International Symposium on Remote Sensing of Environment*, 17th, Ann Arbor, MI, May 9-13, 1983) IN: *Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1*. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 89-102. refs

The use of remotely sensed data to simulate the Universal Soil Loss Equation (USLE) is discussed. Data planes generated from digital Landsat data, digitized soil and precipitation frequency maps, and digitized topographic data have been used to represent the rainfall, soil erodability, length of slope, slope gradient, crop management, and soil loss tolerance coefficients of the USLE. Soil loss due to erosion from rainfall has been accurately predicted for the Santa Paula 7.5 minute quadrangle in California's Ventura County, utilizing the VICAR/IBIS image processing and geographic information system to simulate the USLE. C.D.

A84-40159#

OPERATIONAL USE OF SATELLITE DATA IN CROP CONDITION ASSESSMENT

B. E. SPIERS (U.S. Department of Agriculture, Foreign Agricultural Service, Houston, TX) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 103-107. refs

The purpose of this paper is to describe how the Foreign Agricultural Service (FAS) of the USDA utilizes remotely sensed satellite data in the assessment of crop conditions for selected crops in some areas of the world. The Foreign Crop Condition Assessment Division (FCCAD) is part of the Office of International Agricultural Statistics which has the responsibility within USDA for producing foreign crop production estimates. After five years of developmental work with other government agencies, the FCCAD was established in 1978 to provide FAS with assessments of conditions over selected areas using remotely sensed data as its prime source of data. The FCCAD does not make final production estimates as an end product, but provides reports of assessment that are used as an additional source of information by those that make production estimates. Author

A84-40172#

USING LANDSAT DIGITAL DATA TO IDENTIFY EROSIONAL ZONES IN LA CUENCA ALTA DEL RIO BOGOTA

R. D. MOWER (North Dakota, University, Grand Forks, ND) and M. ARDILA T. (Centro Interamericano de Fotointerpretacion, Bogota, Colombia) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 257-261.

Digital Landsat data for the Embalse de Tomine portion of the Cuenca Alta del Rio Bogota, Colombia, were analyzed using a small interactive microcomputer system (IMPAC). Soil erosion within the study region was located and classified according to categories established by CIAF. Results of the digital analysis were then compared with soil erosion maps produced by INDERENA and CIAF. Correlations between the map produced by IMPAC and those produced from extensive field work were good. Based upon this study, it appears that small microcomputer systems are useful for the analysis of erosional features in the landscape. Author

A84-40174#

REMOTE SENSING OF WIND EROSION IN CROPLANDS

D. J. CARTER (Western Australian Department of Agriculture, Div. of Resource Management, South Perth, Australia) and H. J. HOUGHTON (Western Australian Lands and Surveys Dept., Perth, Australia) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 275-282. refs

Wind erosion has caused considerable damage to the wheat growing areas in Western Australia over the last two years. To assess this damage and to create a data base for future events, Landsat data was used. The Landsat data was found to be accurate for assessing sandblast areas, when there was good backup of aerial and ground information. This was only required for the initial training site identification. The use of Landsat data was found to save both time and money when compared to conventional mapping procedures. It was also sufficiently accurate in a precision processed form to allow for other data sets to be integrated. Author

A84-40175#

CROP IDENTIFICATION AND AREA ESTIMATION IN THE SOUTHERN PART OF THE PROVINCE OF BUENOS AIRES, ARGENTINA - USING LANDSAT DATA

F. V. REDONDO (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 283-291. refs

A84-40183#

THE USE OF A GEOGRAPHIC INFORMATION SYSTEM TO COMBINE LAND USE INFORMATION DERIVED FROM LANDSAT WITH SOILS DATA TO STRATIFY AN AREA IN ARGENTINA FOR CROP FORECASTING

M. DEVRIES, F. WESTIN, M. WEHDE (South Dakota State University, Brookings, SD), F. REDONDO, C. GARGANTINI, N. MARLENKO, and G. VASSALLO (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 381-391.

A84-40187*#

CULTURAL AND ENVIRONMENTAL EFFECTS ON CROP SPECTRAL DEVELOPMENT PATTERNS AS VIEWED BY LANDSAT

E. P. CRIST (Michigan, Environmental Research Institute, Ann Arbor, MI) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 433-442. refs

(Contract NAS9-15476; NAS9-16538)

The typical patterns of spectral development (profiles) for corn and soybeans are presented, based on field-collected reflectance data transformed to correspond to Landsat-MSS Tasseled Cap coordinates. Reasonable variations in field conditions and cultural practices are shown to significantly influence profile features. The separability of the two crops is determined to be primarily related to the maximum value of the reflectance equivalent of Greenness, and to the plateau effect seen in corn Greenness profiles. The impact of changes in conditions on separability is described. In addition, association is made between profile features and stages of development for corn and soybeans. Corn is shown to peak at a stage well before tasseling or maximum LAI, while the characteristics of the soybean profile are shown to be unrelated to any particular stage of development. Author

A84-40188#

ASSESSMENT OF DISEASE-INDUCED YIELD REDUCTION IN COTTON USING SIMULATED SATELLITE IMAGERY

M. C. PARTON, E. N. MULREAN, and O. A. CHADWICK (Arizona, University, Tucson, AZ) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 443-451. refs

A84-40189#

SMALL GRAINS AREA ESTIMATION FOR TRENQUE LAUQUEN PARTIDO USING DIGITAL IMAGE PROCESSING TECHNIQUES

C. GARGANTINI (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 471-480.

Techniques used to estimate the crop cover of small grains in the Trenque Lauquen Partido area of Argentina from Landsat images are described, and preliminary results are reported. A single CCT (for October 9, 1981) and a 1:250,000 image are used to construct a subimage of the area of interest; the farm and field boundaries are marked; an unsupervised clustering-type classification algorithm is applied; training sites are selected; and a total of seven segments in the area are classified and compared with detailed ground-truth data. Although wheat and rye are confused, they are separated from pasture and two types of bare soil. The accuracy of the classification scheme is indicated by the

regression coefficient of 0.89 with ground truth. Maps, tables of polygon statistics, band histograms, and a graph of the linear regression analysis are provided. T.K.

A84-40194#

VEGETATION ASSESSMENT OF THE NORTHERN ARABIAN SHIELD FOR GROUND-WATER EXPLORATION USING EDGE-ENHANCED MSS IMAGES

M. A. TARABZOUNI, Z. M. MUNSHI (Saudi Arabian National Center for Science and Technology, Riyadh, Saudi Arabia), and G. L. BERLIN (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 539-547. refs

Landsat-3 Multispectral Scanner (MSS) digital image data of the Ha'il region of northern Saudi Arabia were subjected to edge-enhancement processing with multiple original data add-back options to highlight small stands of phreatophytic vegetation - an important ground-water indicator. On the basis of a rating detectability scheme for 16 vegetation targets, an edge-enhanced MSS 4, 5, 7 image with 30 percent add-back contained the highest level of vegetation detail. The primary reason for this was that diminution in original data add-back reduced radiometric or albedo masking effects. Author

A84-40197#

ANALYSIS OF MULTI-DATE LANDSAT-GEOPIC FOR MAPPING VINAL (PROSOPIS RUSCIFOLIA) AND ITS TEMPORAL EXPANSION

C. M. VIOLA BINAGHI, A. B. VIOLA, E. G. VIOLA (Aeroteria, S.A., Buenos Aires, Argentina), and W. G. BROONER (Earth Satellite Corp., Chevy Chase, MD) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 575-582.

Rapid proliferation of Vinal, a tree found in the Gran Chaco region of Argentina, impacts both the economy and ecology of Formosa Province. Landsat-GEOPIC digital imagery, combined with effective ground sampling surveys, provided new information on the occurrence and distribution of Vinal in a cost and time effective manner. Changes in extent and distribution of Vinal over a 6,822 sq km study area were analyzed using 1975 and 1980 Landsat data and digital change analyses in the EarthSat GEOPIC Interact system. Results indicate a seven to ten percent annual area increase of Vinal. Landsat GEOPIC processing was used to generate images and distribution (land cover) and change analysis maps at 1:100,000 scale. Author

A84-40199#

MAPPING OF PHYTOECOLOGICAL UNITS OF THE 'CERRADOS' OF THE CENTRAL PLATEAUS OF BRAZIL

Y. SIMAS ENEAS (Superintendencia de Recursos Naturais e Meio Ambiente, Rio de Janeiro, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 597-604. refs

The 'cerrado' represents the typical vegetation physiognomy of the Central Plateau of Brazil. In the last few years, a number of studies of the regions occupied by the 'cerrado' have been conducted by government agencies in connection with the desire for an extension of the agricultural areas. These studies provided basic information for the design of synthesis maps, taking into account the mapping of phytoecological units of the 'cerrados'. The mapping of the Cuiaba sheet led to the identification of 13 phytoecological units. A description is given of the most significant units, including the Parecis Plateau, Alto Guapore, Alto Garcas, and Cuiaba Pediplain. It is found that the remote sensing technique provides an excellent working tool for the identification of broad phytoecological units. However, much additional information is needed. G.R.

A84-40200#

EVALUATION AND DEVELOPMENT OF TECHNIQUES FOR CROP INVENTORY IN THE WHEATBELT OF WESTERN AUSTRALIA USING SATELLITE DATA

N. A. CAMPBELL, F. R. HONEY, P. T. HICK, and M. D. W. CARLTON (Commonwealth Scientific and Industrial Research Organization, Perth, Australia) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 607-615. refs

A84-40201#

EVALUATION OF SPATIAL FILTERING ON THE ACCURACY OF WHEAT AREA ESTIMATE

M. A. MOREIRA, S. C. CHEN, and A. M. DE LIMA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 617-624.

A 3 x 3 pixel spatial filter for postclassification was used for wheat classification to evaluate the effects of this procedure on the accuracy of area estimation using Landsat digital data obtained from a single pass. Quantitative analyses were carried out in five test sites (approx 40 sq km each) and t tests showed that filtering with threshold values significantly decreased errors of commission and omission. In area estimation filtering improved the overestimate of 4.5 percent to 2.7 percent and the root-mean-square error decreased from 126.18 ha to 107.02 ha. Extrapolating the same procedure of automatic classification using spatial filtering for postclassification to the whole study area, the accuracy in area estimate was improved from the overestimate of 10.9 percent to 9.7 percent. It is concluded that when single pass Landsat data is used for crop identification and area estimation the postclassification procedure using a spatial filter provides a more accurate area estimate by reducing classification errors. Previously announced in STAR as N82-33792 Author

A84-40205#

COASTAL ZONE MAPPING OF GUYANA USING DIGITAL LANDSAT DATA

V. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada) and B. BRUCE (Canada Centre for Remote Sensing, Ottawa, Canada) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 659-680. refs

As a consequence of the accelerating development of the coastal zone of Guyana, it has become necessary to map the resources of this region in detail. Aspects of development are related to feeder road construction, agricultural productivity, offshore fisheries development, drainage, irrigation, and sea defense. Of the required data, only little is currently available. An acquisition of the needed data by traditional methods would be prohibitively expensive, and the use of a combination of digital Landsat data and existing aerial photography has been considered. The present investigation is concerned with a demonstration of the potential contribution which Landsat data could make to coastal zone management in cases in which little other information is available. The study area considered includes the flat coastal plain and offshore area between the Demerara and the Berbice Rivers. It is found that Landsat imagery can make a significant contribution to the data bases needed for the development work. G.R.

A84-40215#

UTILISATION OF LANDSAT DATA FOR DELINEATING MAPPING AND MANAGING OF SOIL RESOURCES - THE PROBLEMS AND PROSPECTS UNDER INDIAN CONDITIONS

A. N. SINGH, L. VENKATARATNAM, K. R. RAO, R. S. DWIVEDI (National Remote Sensing Agency, Hyderabad, India), A. K. SINHA, and P. VENKATACHALAM (Indian Institute of Technology, Bombay, India) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 787-796. refs

The utility of Landsat data, both digital and analog, for small scale mapping of soils and their limitations/hazards has been discussed in this paper. The areas covered for mapping of soil resources by using Landsat multispectral data in India are shown. Both image oriented as well as computer-aided numerical approaches have been used in this study. Delineation of areas affected by salinity/alkalinity, erosion, water logging, etc., have been successfully done for some areas in the country. The problems and prospects in utilization of Landsat data for mapping of soils and their limitations have also been discussed. Author

A84-40216#

VEGETATION SURVEY IN AMAZONIA USING LANDSAT DATA

Y. E. SHIMABUKURO, J. R. DOS SANTOS (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil), and L. C. S. DE AQUINO (Comissao Estadual de Planejamento Agricola, Manans, Brazil) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 797-802. refs

Automatic Image-100 analysis of Landsat data was performed using the MAXVER classification algorithm. In the Pilot area, four vegetation units were mapped automatically in addition to the areas occupied for agricultural activities. The Image-100 classified results together with a soil map and information from RADAR images, permitted the establishment of the final legend with six classes: semi-deciduous tropical forest; low land evergreen tropical forest; secondary vegetation; tropical forest of humid areas, predominant pastureland and flood plains. Two water types were identified based on their sediments indicating different geological and geomorphological aspects. Previously announced in STAR as N83-14577 A.R.H.

A84-40221#

EVALUATION OF TRADITIONAL AND 'GREEN MEASURE' REMOTE SENSING TECHNIQUES FOR SHRUB CROP ASSESSMENT IN SRI LANKA

J. S. OTT (Michigan, Environmental Research Institute, Ann Arbor, MI) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 855-864. refs

A84-40223#

EVALUATION OF REFORESTATION USING REMOTE SENSING TECHNIQUES

P. HERNANDEZ FILHO, Y. E. SHIMABUKURO, and J. R. DOS SANTOS (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 885-897.

The objective of this paper is to evaluate the utilization of remotely sensed orbital data for forestry inventory. The study area (approximately 491,100 ha) encompasses the municipalities of Ribeirao Preto, Altinopolis, Cravinhos, Serra Azul, Luis Antonio, Sao Simao, Santa Rita do Passa Quatro and Santa Rosa do

Viterbo (Sao Paulo State). Materials used were Landsat data from channels 5 and 7 (scale 1:250,000) and CCTs. Visual interpretation of the imagery showed that for 1977 a total of 37,766.00 ha and for 1979, 38,003.75 ha were reforested with pinus and eucalyptus within the area under study. The results obtained show that Landsat data can be used efficiently in forestry inventory studies. Previously announced in STAR as N83-14585 Author

A84-40224#

ON A NEW REFLECTION MODEL FOR THE CORN FIELD

Y. HABA, M. SHIKADA, K. MIYAKITA, and S. UENO (Kanazawa Institute of Technology, Kanazawa, Ishikawa, Japan) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 893-903. refs

Despite different count levels due to angular effects caused by rough surfaces (corn, rice, and vegetable fields), aircraft or satellite multispectral scanner data (MSS) are believed to be an efficient way to obtain information on a ground surface. In order to obtain ground truth data quickly and inexpensively, a new reflection model for Japanese paddy fields has been proposed. Various aspects of these fields can be established by manipulating rice plant reflectance and angle parameters. Results have indicated that the imagery distortion caused by the rough-surface angular effects is greater and more important than that caused by other effects. In the model, ground truth data is directly available for checking MSS data accuracy, but actual MSS and ground truth data are accompanied by intrinsic and inevitable errors when objects on the ground have rough surfaces like those of a paddy field. Further research is suggested. J.P.

A84-40230*#

USING KNOWLEDGE OF AGRICULTURAL PRACTICES TO ENHANCE THROUGH-THE-SEASON INTERPRETATION OF LANDSAT DATA

W. A. MALILA (Michigan, Environmental Research Institute, Ann Arbor, MI) and C. R. PESTRE (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 957-962. refs (Contract NAS9-15476)

Landsat data contain features that can be interpreted to produce information about crops, in support of crop estimation procedures. This paper considers ways in which detailed knowledge of agricultural practices and events might increase and improve the utilization of Landsat data in both the predictive and observational or measurement components of such procedures. Landsat observables related to agricultural practices and events throughout the cropping season are listed. Agricultural fields are identified as the preferred observational units for incorporating refined agricultural understanding, such as crop rotation patterns, into machine procedures. Uses of Landsat data from both prior seasons and the current season are considered, as is use of predictive models of crop appearance. The investigation of knowledge engineering systems tailored to through-the-season estimation problems is recommended for long range development. Author

A84-40231*# California Univ., Santa Barbara.

IMPROVEMENTS IN FOREST CLASSIFICATION AND INVENTORY USING REMOTELY SENSED DATA

C. E. WOODCOCK, J. FRANKLIN, A. H. STRAHLER (California, University, Santa Barbara, CA), and T. L. LOGAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 963-974. refs

A Forest Classification and Inventory System (Focis) has been developed for large area forest inventories on the basis of Landsat

and digital terrain data. It is a potential advantage of Focis that it can provide timely inventories at a reduced cost which are easily updated. The Klamath National Forest in Northern California was employed as test area for the initial development of Focis. Focis is constantly being changed and improved. Two recent additions to the inventory system include a spatial filtering algorithm which improves the spatial coherence in the final classified image, and a modification to the classification procedure designed to reduce the adverse effects of local topography on classification accuracy. Attention is given to a Focis overview, spatial filtering, the interface with the forest service geographic information system, and efforts to reduce the influence of topography. G.R.

A84-40232#

INTERPRETABILITY OF LANDSAT IMAGES FOR PHYSIOGRAPHY AND SOIL MAPPING IN THE SUB-HUMID REGION OF THE NORTHEAST OF ARGENTINA

J. M. SAYAGO (Tucuman, Universidad Nacional, San Miguel de Tucuman, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 977-987. refs

A84-40233#

MODELING SOYBEAN DEVELOPMENT FROM DAYLENGTH AND TEMPERATURE DATA

A. C. RAVELO, A. M. PLANCHUELO RAVELO (Missouri, University, Columbia, MO), and A. J. PASCALE (Buenos Aires, Universidad, Buenos Aires, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 991-996. refs

A soybean growth stage model has been developed using an integrative regression analysis (IRA) technique. IRA relates the span of days for soybean growth stages to daylength and daily air temperatures and evaluates their contribution to soybean development. Dates for significant crop growth stages such as the beginning of lowering, beginning of pod development, the end of pod development, the beginning of leaf senescence and leaf falling were recorded for three soybean cultivars. A total of 16 planting dates during seven growing seasons provided a number of temperature and daylength treatments. In order to test the model three planting dates selected at random were withdrawn from the IRA. Comparisons of the estimated phenological dates and those observed from the test data suggest that the soybean growth model would be a good tool for satellite imagery analysis of soybean growth. I.H.

A84-40238#

ESTIMATION OF THE SUGAR CANE CULTIVATED AREA FROM LANDSAT IMAGES USING THE TWO PHASE SAMPLING METHOD

C. A. CAPPELLETTI, F. J. MENDONCA, D. C. L. LEE, and Y. E. SHIMABUKURO (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 1055-1057.

A two phase sampling method and the optimal sampling segment dimensions for the estimation of sugar cane cultivated area were developed. This technique employs visual interpretations of Landsat images and panchromatic aerial photographs considered as the ground truth. The estimates, as a mean value of 100 simulated samples, represent 99.3 percent of the true value with a CV of approximately 1 percent; the relative efficiency of the two phase design was 157 percent when compared with a one phase aerial photographs sample. Previously announced in STAR as N83-14586 Author

A84-40310* Pennsylvania Univ., Philadelphia.

CIRCUMNUTATION OBSERVED WITHOUT A SIGNIFICANT GRAVITATIONAL FORCE IN SPACEFLIGHT

A. H. BROWN (Pennsylvania, University, Philadelphia, PA) and D. K. CHAPMAN (University City Science Center, Philadelphia, PA) Science (ISSN 0036-8075), vol. 225, July 13, 1984, p. 230-232. refs

(Contract NGR-39-030-010; NGR-39-010-149; NAS9-15340; NAS9-15531)

For over half a century and especially since the 1960's a number of plant physiologists, seeking to explain the impressively ubiquitous mechanism that drives and regulates circumnutation in all growing plant organs, have been unable to agree on whether the differential growth process that leads to circumnutational oscillations is gravity dependent. There has been fairly general agreement that the question might be answered, if test plants could be deprived of all significant gravitational stimuli as would be possible in the near weightlessness or free fall environment of satellite orbit. Such an experiment was carried out during the Spacelab 1 mission. Circumnutational oscillations were observed which demonstrated that a protracted input of gravitational information from the environment was not required for initiation or maintenance of circumnutation in sunflower hypocotyls. Author

A84-40545

THE ESTIMATION OF GREEN-LEAF-AREA INDEX FROM REMOTELY SENSED AIRBORNE MULTISPECTRAL SCANNER DATA

N. W. WARDLEY and P. J. CURRAN (Sheffield, University, Sheffield, England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 671-679. Research supported by the Natural Environment Research Council. refs

A84-40546

AGRICULTURAL LAND-COVER DISCRIMINATION USING THEMATIC MAPPER SPECTRAL BANDS

J. R. G. TOWNSHEND (Reading, University, Reading, Berks., England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 681-698. Sponsorship: Natural Environment Research Council. refs

(Contract NERC-F60/G6/03)

A84-40548

EFFECTS OF OFF-NADIR VIEW ANGLES ON THE DETECTED SPECTRAL RESPONSE OF VEGETATION CANOPIES

M. J. BARNESLEY (Reading, University, Reading, Berks., England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 715-728. refs

The effect of view angle upon the detected spectral response of vegetation canopies is studied, using NERC 1982 airborne multispectral scanner campaign data. An attempt is made to distinguish between the effects of atmosphere and the anisotropic reflectance of vegetation canopies. The influence of atmospheric backscatter is found to be greatest at very short wavelengths (0.42-0.45 micron). Preliminary results confirm that the detected spectral response of vegetation canopies varies with view angle and that the nature and extent of these variations are wavelength-dependent and cover-type dependent. In general, direction-dependent reflectance is symmetric about the nadir value for the visible wavebands, but is manifestly asymmetric in the far-red to near-infrared wavebands. Off-nadir effects for vegetation canopies are found to be smallest in the middle-infrared wavebands. Author

01 AGRICULTURE AND FORESTRY

A84-41177

EXAMPLE OF THE USE OF REMOTE SENSING IN FRANCE - CARTOGRAPHY OF FOREST FIRES [EXEMPLE D'UTILISATION DE LA TELEDTECTION EN FRANCE - LA CARTOGRAPHIE DES FEUX DE FORET]

A. HUSSON (Paris, Ecole Nationale Supérieure des Mines, Valbonne, Alpes-Maritimes, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 15-25, 27. In French.

A84-41183

COMPARATIVE STUDY OF SPOT AND LANDSAT-D SIMULATIONS IN AN AGRICULTURAL AND SUBURBAN AREA OF SOUTHERN QUEBEC [UNE ETUDE COMPARATIVE DE SIMULATIONS SPOT ET LANDSAT-D DANS UN MILIEU AGRICOLE ET PERIURBAIN DU SUD DU QUEBEC]

G. CLICHE, F. BONN, O. DUPONT, M. CARIGNAN, and L. CHARBONNEAU (Sherbrooke, Universite, Sherbrooke, Quebec, Canada) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 111-123. In French. refs

A84-41185

SIMULATION OF SPOT STEREO PAIRS IN A FOREST REGION [SIMULATION DE COUPLES STEREOSCOPIQUES SPOT EN ZONE FORESTIERE]

R. SIMARD and P. TEILLET (Canada Centre for Remote Sensing, Ottawa, Canada) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 133-149. refs

A84-41189

A COMPARISON OF LANDSAT-D AND SPOT SENSORS FOR AN AGRICULTURAL THEME [COMPARAISON DES CAPTEURS DE LANDSAT-D ET DE SPOT SUR LE THEME AGRICULTURE]

G. SAINT and A. PODAIRE (Centre National d'Etudes Spatiales, Toulouse, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 193-203. In French.

A numerical simulation technique was developed in anticipation of using Landsat-D and SPOT imagery for agricultural applications. Airborne imagery were taken with equivalent sensors and then extrapolated to expected spacecraft altitudes. The radiometric performances of the SPOT high resolution visible (HRV) and Landsat-D thematic mapper (TM) and multispectral scanner (MSS) were modeled in terms of response curves to specific wavelengths. Three agricultural areas were studied and attention was given to geometric characteristics of the viewing area. The HRV was offered the highest resolution in terms of pure pixel responses to crop areas less than 30 m across. Multitemporal images were also taken of winter wheat and springtime maize, sorghum and sunflowers to track crop growth. The results lead to the expectation that SPOT imagery will be useful for monitoring crop growth in small land parcels, although variations of color indicating differences in crop vigor within the parcels may not be discernable. M.S.K.

A84-41192

SPOT SIMULATIONS AND AERIAL DATA IN BEAUCE [SIMULATIONS SPOT ET DONNEES AERIENNE EN BEAUCE]

M. POUSSE and P. CLERGEOT (Paris I, Universite, Paris, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 223-235. In French.

A84-41195

SPOT SIMULATIONS - THE DEATH OF OAKS IN THE TRONCAIS FOREST [SIMULATIONS SPOT - LE DEPERISSEMENT DU CHENE EN FORET DE TRONCAIS]

J. RIOM, P. MOUHOT (Institut National de la Recherche Agronomique, Cestas, Gironde, France), and C. TORRES (Groupement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 275-286. In French.

A84-41955

A STATE-WIDE LANDSAT DATA BASE AS A SOURCE OF LAND RESOURCE INFORMATION FOR PENNSYLVANIA

B. J. TURNER and G. M. BAUMER (Pennsylvania State University, University Park, PA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings . Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 35-44. refs

A recently installed mosaicked Landsat data base for the state of Pennsylvania is discussed which provides a base of undfoliated forest data to assist in statewide mapping of gypsy moth defoliation and makes geometrically correct data accessible by political, jurisdictional, or arbitrary boundaries to a variety of users. The data selection and map projection, mosaic creation, reformatting of the data base, subsetting from the data base, development of a user-friendly front end, data management and construction of additional data layers, costs, and anticipated uses are addressed. C.D.

A84-41957

ASSESSMENT OF WILDLAND FUEL HAZARDS IN BIG BASIN REDWOODS STATE PARK, CALIFORNIA

A. BENSON (California, University, Berkeley, CA), J. GREENLEE, and J. LANGENHEIM (California, University, Santa Cruz, CA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings . Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 55-63. Research sponsored by the California Department of Parks and Recreation.

Maps representing the distribution and quantities of vegetation, fuels, and potential fire behavior were developed for the Big Basin Redwoods State Park, CA. These maps were based on a stratification extracted from a digital data bank and on an extensive sample of ground conditions. The sample data were used to quantify the stratification, thereby producing simple choropleth maps of these parameters. Author

A84-41971* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A STATEWIDE LANDSAT DIGITAL DATA BASE FOR FOREST INSECT DAMAGE ASSESSMENT
 D. L. WILLIAMS, C. L. DOTTAVIO, and R. F. NELSON (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, MD) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 191-203.

A Joint Research Project (JRP) involving NASA/Goddard Space Flight Center and the Pennsylvania Bureau of Forestry/Division of Forest Pest Management demonstrates the utility of Landsat data for assessing forest insect damage. A major effort within the project has been the creation of map-registered, statewide Landsat digital data base for Pennsylvania. The data base, developed and stored on computers at the Pennsylvania State University Computation Center, contains Landsat imagery, a Landsat-derived forest resource map, and digitized data layers depicting Forest Pest Management District boundaries and county boundaries. A data management front-end system was also developed to provide an interface between the various layers of information within the data base and image analysis software. This front-end system insures that an automated assessment of defoliation damage can be conducted and summarized by geographic area or jurisdiction of interest. Author

A84-41986* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

USER ALTERNATIVES IN POST-PROCESSING FOR RASTER-TO-VECTOR CONVERSION

T. L. LOGAN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) and C. E. WOODCOCK (California, University, Santa Barbara, CA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 397-407. refs (Contract NAS7-100)

A number of Landsat-based coniferous forest stratum maps have been created of the Eldorado National Forest in California. These maps were produced in raster image format which is not directly usable by the U.S. Forest Service's vector-based Wildland Resource Information System (WRIS). As a solution, raster-to-vector conversion software has been developed for processing classified images into polygonal data structures. Before conversion, however, the digital classification images must be simplified to remove high spatial variance ('noise', 'speckle') and meet a USFS ten acre minimum requirement. A post-processing (simplification) strategy different from those commonly used in raster image processing may be desired for preparing maps for conversion to vector format, because simplification routines typically permit diagonal connections in the process of reclassifying pixels and forming new polygons. Diagonal connections are often undesirable when converting to vector format because they permit polygons to effectively cross over each other and occupy a common location. Three alternative methodologies are discussed for simplifying raster data for conversion to vector format. Author

A84-41997

REMOTE SENSING OF TERRAIN SUITABILITY FOR LAMBING OF DALL'S SHEEP - DEMPSTER HIGHWAY CORRIDOR, YUKON

D. L. STEWART (Calgary, University, Calgary, Alberta, Canada) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 513-523. refs

A84-42924

LIMITS AND CONDITIONS ON THE USE OF REMOTE SENSING FOR CROP-INVENTORY AND LAND-USE STUDIES IN DEVELOPING COUNTRIES [CONTRAINTES ET CONDITIONS DE L'UTILISATION DE LA TELEDETECTION POUR L'INVENTAIRE DES CULTURES ET LE SUIVI DE L'UTILISATION DU SOL DANS LES PAYS EN VOIE DE DEVELOPPEMENT]

M. BIED-CHARRETTON (Ministere des Relations Exterieures /Cooperation/ Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 93, 1984, p. 5-13. In French.

Climatic, geographical, technological, and economic factors affecting the application of satellite remote-sensing data to agricultural management in developing countries (DCs) are reviewed. The climates typical of DCs (equatorial, tropical, or desert) and the associated cloud-cover and fog-cover problems are examined; the dominant geological formations, vegetation types, and agricultural patterns are listed; the role of rapid urbanization in DCs is indicated; the limited economies of the emerging and least developed subgroups of DCs are characterized; and the advantages of satellite remote sensing are explained. Present and planned satellite spatial resolutions, image-acquisition schemes, and utilization methods are summarized; political problems of access are considered; and the responsibilities of the industrialized nations are defined. The French foreign-aid programs applicable to the remote-sensing field are described in an appendix. T.K.

A84-43213

ESTIMATION OF RECOGNIZABILITY IN REMOTE-SENSING PROBLEMS [OTSENKA RASPOZNAVAEMOSTI V ZADACHAKH DISTANTSIONNYKH ISSLEDOVANI]

O. GUIASH and T. FARAGO (Kozponti Meteorologiai Intezet, Budapest, Hungary) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 83-88. In Russian. refs

A statistical method is developed for estimating the theoretical limit of pattern recognizability in remote-sensing problems. The method is grounded theoretically, and its effectiveness is illustrated on the example of the analysis of data from a Meteor-satellite scanner. B.J.

A84-43676* State Univ. of New York, Syracuse.

RECORDED RADIANCE INDICES FOR VEGETATION MONITORING USING NOAA AVHRR DATA; ATMOSPHERIC AND OTHER EFFECTS IN MULTITEMPORAL DATA SETS

M. J. DUGGIN (New York, State University, Syracuse, NY) and D. PIWINSKI (PAR Technology Corp., Image Exploitation Systems Section, New Hartford, NY) Applied Optics (ISSN 0003-6935), vol. 23, Aug. 1, 1984, p. 2620-2623. refs (Contract NAS9-16783; NAS9-16514)

Work is reported in which a series of cloud-free portions of digital imagery obtained over the Great Plains area of the U.S.A. by the NOAA advanced very high resolution radiometer (AVHRR) throughout the crop growing season were examined in order to study date-dependent and scan-angle-dependent variations in recorded radiance in each sensor channel. Combinations of radiance recorded in different channels (vegetative indices; VINs) were also studied. The problem of atmospheric variation between acquisitions is discussed and some suggestions are made for work which may further improve cloud screening procedures and which

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may result in vegetation indices which are less affected by atmospheric effects. Author

A84-44138

THEMATIC MAPPING FROM MULTITEMPORAL IMAGE DATA USING THE PRINCIPAL COMPONENTS TRANSFORMATION

J. A. RICHARDS (New South Wales, University, Kensington, Australia) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 35-46. refs

The principal components transformation is used to highlight regions of localized change evident in satellite multispectral imagery associated with bushfire damage and with vegetation regrowth following fire burns. In line with previous studies by other investigators it is the higher order components that are seen to lead to change enhancement. These components are classified by unsupervised techniques to yield thematic maps on which change classes are recorded. In this manner, confusion of class signatures between dynamic and static cover types is avoided. In the present case this relates to confusion between fire burn regions and water edge mixed pixels. Author

A84-44140*

National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EFFECTS OF CORN STALK ORIENTATION AND WATER CONTENT ON PASSIVE MICROWAVE SENSING OF SOIL MOISTURE

P. E. ONEILL, B. J. BLANCHARD, J. R. WANG, W. I. GOULD (NASA, Goddard Space Flight Center, Greenbelt, MD), and T. J. JACKSON (U.S. Department of Agriculture, Hydrology Laboratory, Beltsville, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 55-67. refs

A field experiment was conducted utilizing artificial arrangements of plant components during the summer of 1982 to examine the effects of corn canopy structure and plant water content on microwave emission. Truck-mounted microwave radiometers at C (5 GHz) and L (1.4 GHz) band sensed vertically and horizontally polarized radiation concurrent with ground observations of soil moisture and vegetation parameters. Results indicate that the orientation of cut stalks and the distribution of their dielectric properties through the canopy layer can influence the microwave emission measured from a vegetation/soil scene. The magnitude of this effect varies with polarization and frequency and with the amount of water in the plant, disappearing at low levels of vegetation water content. Although many of the canopy structures and orientations studied in this experiment are somewhat artificial, they serve to improve understanding of microwave energy interactions within a vegetation canopy and to aid in the development of appropriate physically based vegetation models. Author

A84-44925

LANDSAT-AIDED FOREST SITE TYPE MAPPING

T. HAME (Technical Research Centre of Finland, Espoo, Finland) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Aug. 1984, p. 1175-1183. refs

Forest site types were interpreted with a maximum likelihood classification of Landsat imagery. On the basis of such interpretation, an operational system for site type classification was developed. A spectral site type model was also created. The study area was situated in northern Finland near the Arctic Circle. The numerical interpretation was tested by random sampling. Some classes were accurate enough for an operational system without field checking. About two-thirds of the area needed more information. The new forest site type classification method, entitled KAUKO, is a multi-phase system. The first phase is the interpretation of Landsat MSS imagery, followed by utilization of base map data, visual interpretation of color infrared photographs, and field checking. With KAUKO it was possible to make the forest site type classification three times as fast as with the traditional method. More than one quarter of the expenses of this classification were saved by using the KAUKO method in test classification. Author

A84-49033

RADIOMETRIC CORRECTION OF EARTH-RESOURCES REMOTE-SENSING DATA OBTAINED WITH THE MKF-6 CAMERA - METHOD AND UTILIZATION OF RESULTS [RADIOMETRICHESKAIA KORREKTSIIA MATERIALOV AEROKOSMICHESKOI S'EMKI ZEMLI KAMEROI MKF-6 - METODIKA I ISPOL'ZOVANIE REZUL'TATOV]

F. KH. A. LOPES (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovani, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 89-94. In Russian. refs

A84-49035

SOME APPROACHES TO THE ORGANIZATION OF A DATA BANK FOR A SYSTEM FOR THE SPACEBORNE REMOTE SENSING OF EARTH RESOURCES THE EXAMPLE OF AGRICULTURE [NEKOTORYE PODKHODY K ORGANIZATSII BANKA DANNYKH SISTEMY IZUCHENIIA PRIRODNYKH RESURSOV ZEMLI IZ KOSMOSA - NA PRIMERE SEL'SKOGO KHOZIAISTVA]

IU. G. SIMONOV, N. F. DEREVIANKO, and G. I. BARVYN (Moskovskii Gosudarstvennyi Universitet; Vsesoiuznyi Nauchno-Issledovatel'skii Institut Orgtekhniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 103-109. In Russian. refs

A84-49138*#

National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

ANALYSIS OF LANDSAT-4 THEMATIC MAPPER DATA FOR CLASSIFICATION OF FOREST STANDS IN BALDWIN COUNTY, ALABAMA

C. L. HILL (NASA National Space Technology Laboratories, Earth Resources Laboratory, Bay St. Louis, MS) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 110-121. refs

A computer-implemented classification has been derived from Landsat-4 Thematic Mapper data acquired over Baldwin County, Alabama on January 15, 1983. One set of spectral signatures was developed from the data by utilizing a 3x3 pixel sliding window approach. An analysis of the classification produced from this technique identified forested areas. Additional information regarding only the forested areas. Additional information regarding only the forested areas was extracted by employing a pixel-by-pixel signature development program which derived spectral statistics only for pixels within the forested land covers. The spectral statistics from both approaches were integrated and the data classified. This classification was evaluated by comparing the spectral classes produced from the data against corresponding ground verification polygons. This iterative data analysis technique resulted in an overall classification accuracy of 88.4 percent correct for slash pine, young pine, loblolly pine, natural pine, and mixed hardwood-pine. An accuracy assessment matrix has been produced for the classification. Author

A84-49140*#

National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

AGRICULTURAL APPLICATIONS OF TM DATA

D. E. PITTS, R. BIZZELL, G. BADHWAR, D. THOMPSON, K. HENDERSON (NASA, Johnson Space Center, Houston, TX), S. SHEN, C. SORENSEN, and J. CARNES (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 134-146. refs

Multitemporal Thematic Mapper, Thematic Mapper Simulator, and detailed ground truth data were collected for a 9- by 11-km sample segment in Webster County, Iowa, in the summer of 1982. Three dates were acquired each with Thematic Mapper Simulator (June 7, June 23, and July 31) and Thematic Mapper (August 2, September 3, and October 21). The additional TM spectral bands in the middle infrared were found to substantially improve

corn/soybean separability in both single date and multitemporal analyses. Author

A84-49141*# California Univ., Berkeley.

EVOLUTION OF LANDSAT-4 IMAGE QUALITY FOR THE INTERPRETATION OF FOREST, AGRICULTURAL AND SOIL RESOURCES

S. D. DEGLORIA, A. S. BENSON, and R. N. COLWELL (California, University, Berkeley, CA) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 147-161. refs (Contract NAS5-27377)

Landsat-4 Multispectral Scanner (MSS) and Thematic Mapper (TM) sensor performance is being evaluated through the analysis of images generated by computer-compatible tape data and commercially available film products. Natural targets are used to evaluate spectral variability, spatial resolution, radiometric sensitivity, and geometric fidelity. Spectral characteristics are being evaluated through the interpretation of the image tone and texture variability of known features, while spatial characteristics are evaluated through lineal and areal estimates of similar features and the plotting and analysis of residual errors derived from regressions between relative image coordinates and map coordinates. O.C.

A84-49152#

TESTING AN APPLICATION USING SPOT SIMULATED IMAGERY - CROP INVENTORY

G. SAINT (Centre National d'Etudes Spatiales, Toulouse, France) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 302-306. Research supported by the Service Central des Enquetes et Etudes Statistiques.

Simulated SPOT images were analyzed to test the use of SPOT data in crop inventory systems. The images were obtained from an airborne Daedalus scanner over three test sites of about 2500 hectares. The Daedalus images were processed to get the SPOT multispectral channels with a resolution of 20 m. The data acquired at four different dates were classified and the results evaluated for their use in cartography and statistical inventory: they were found to allow the same order of accuracy as the Landsat MSS data but on fields with a mean area of about 2 hectares. Author

N84-29278*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ANALYSIS OF NORMALIZED RADAR CROSS SECTION (SIGMA-O) SIGNATURE OF AMAZON RAIN FOREST USING SEASAT SCATTEROMETER DATA

E. M. BRACALENTE and J. L. SWEET (Kentrion International, Inc., Hampton, Va.) Aug. 1984 116 p refs ERTS (E84-10168; NASA-TM-85779; L-15749; NAS 1.15:85779) Avail: NTIS HC A06/MF A01 CSCL 02F

The normalized radar cross section (NRCS) signature of the Amazon rain forest was SEASAT scatterometer data. Statistics of the measured (NRCS) values were determined from multiple orbit passes for three local time periods. Plots of mean normalized radar cross section, dB against incidence angle as a function of beam and polarization show that less than 0.3 dB relative bias exists between all beams over a range of incidence angle from 30 deg to 53 deg. The backscattered measurements analyzed show the Amazon rain forest to be relatively homogeneous, azimuthally isotropic and insensitive to polarization. The return from the rain forest target appears relatively consistent and stable, except for the small diurnal variation (0.75 dB) that occurs at sunrise. Because of the relative stability of the rain forest target and the scatterometer instrument, the response of versus incidence angle was able to detect errors in the estimated yaw altitude angle. Also, small instrument gain biases in some of the processing channels were detected. This led to the development of an improved NRCS algorithm, which uses a more accurate method for estimating the system noise power. Author

N84-30387*# Environmental Research Inst. of Michigan, Ann Arbor.

THEMATIC MAPPER SPECTRAL DIMENSIONALITY AND DATA STRUCTURE

E. P. CRIST and R. C. CICONE /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 28-31 Jul. 1984 ERTS Avail: NTIS HC A09/MF A01 CSCL 08B

Thematic Mapper data, simulated from field and laboratory spectrometer measurements of a variety of agricultural crops and a wide range of soils, are analyzed to determine their dispersion in the six space defined by the reflective TM bands (i.e., excluding the thermal band). While similar analyses of MSS data from agricultural scenes show that the vast majority of the MSS data occupy a single plane, the simulated TM data primarily occupy three dimensions, defining two intersecting planes and a zone of transition between the two. Viewing the plane of Vegetation head on provides a projection comparable to the single plane of MSS data. The Plane of Soils and transition zone represent new information made available largely as a result of the longer infrared bands included in the Thematic Mapper. A transformation, named the Thematic Mapper Tasseled Cap, is presented which rotates the TM data such that the described data structure is most readily accessible to view. M.A.C.

N84-30400*# State Univ. of New York, Syracuse.

THE EFFECT OF POINT-SPREAD FUNCTION INTERACTION WITH RADIANCE FROM HETEROGENEOUS SCENES ON MULTITEMPORAL SIGNATURE ANALYSIS

M. J. DUGGIN and L. B. SCHOCH /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 64-68 Jul. 1984 refs ERTS Avail: NTIS HC A09/MF A01 CSCL 08B

The point-spread function is an important factor in determining the nature of feature types on the basis of multispectral recorded radiance, particularly from heterogeneous scenes and particularly from scenes which are imaged repetitively, in order to provide thematic characterization by means of multitemporal signature. To demonstrate the effect of the interaction of scene heterogeneity with the point spread function (PSF), a template was constructed from the line spread function (LSF) data for the thematic mapper photoflight model. The template was in 0.25 (nominal) pixel increments in the scan line direction across three scenes of different heterogeneity. The sensor output was calculated by considering the calculated scene radiance from each scene element occurring between the contours of the PSF template, plotted on a movable mylar sheet while it was located at a given position. Author

N84-30411*# California Univ., Berkeley. Remote Sensing Research Program.

CHARACTERIZATION OF LANDSAT-4 TM AND MSS IMAGE QUALITY FOR INTERPRETATION OF AGRICULTURAL AND FOREST RESOURCES Abstract Only

S. D. DEGLORIA and R. N. COLWELL /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 98-102 Jul. 1984 ERTS Avail: NTIS HC A09/MF A01 CSCL 08B

Systematic analysis of both image and numeric data shows that the overall spectral, spatial, and radiometric quality of the TM data are excellent. Spectral variations in fallow fields are due to the variability in soil moisture and surface roughness resulting from the various stages of field preparation for small grains production. Spectrally, the addition of the first TM short wave infrared band (Band 5) significantly enhanced ability to discriminate different crop types. Bands 1, 5, and 6 contain saturated pixels due to high albedo effects, low moisture conditions, and high radiant temperatures of granite and dry, bare soil on south facing slopes, respectively. Spatially, the two fold decrease in interpixel distance and four fold decrease in area per pixel between the TM and MSS allow for improved discrimination of small fields, boundary conditions, road and stream networks in rough terrain, and small

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forest clearings resulting from various forest management practices. A.R.H.

N84-30414*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

AN INITIAL ANALYSIS OF LANDSAT-4 THEMATIC MAPPER DATA FOR THE DISCRIMINATION OF AGRICULTURAL, FORESTED WETLAND, AND URBAN LAND COVERS

D. A. QUATTROCHI /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 111-112 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

An initial analysis of LANDSAT 4 Thematic Mapper (TM) data for the discrimination of agricultural, forested wetland, and urban land covers is conducted using a scene of data collected over Arkansas and Tennessee. A classification of agricultural lands derived from multitemporal LANDSAT Multispectral Scanner (MSS) data is compared with a classification of TM data for the same area. Results from this comparative analysis show that the multitemporal MSS classification produced an overall accuracy of 80.91% while the TM classification yields an overall classification accuracy of 97.06% correct. M.A.C.

N84-30419*# Delaware Univ., Newark. Coll. of Marine Studies. **ABOVEGROUND BIOMASS ESTIMATION IN A TIDAL BRACKISH MARSH USING SIMULATED THEMATIC MAPPER SPECTRAL DATA**

M. HARDISKY and V. KLEMAS /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 121-127 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08H

Spectral radiance data were collected from the ground and from a low altitude aircraft in an attempt to gain some insight into the potential utility of actual Thematic Mapper data for biomass estimation in wetland plant communities. No attempt was made to distinguish individual plant species within brackish marsh plant associations. Rather, it was decided to lump plant species with similar canopy morphologies and then estimate from spectral radiance data the biomass of the group. The rationale for such an approach is that plants with a similar morphology will produce a similar reflecting or absorbing surface (i.e., canopy) for incoming electromagnetic radiation. Variations in observed reflectance from different plant communities with a similar canopy morphology are more likely to be a result of biomass differences than a result of differences in canopy architecture. If the hypothesis that plants with a similar morphology exhibit similar reflectance characteristics is true, then biomass can be estimated based on a model for the dominant plant morphology within a plant association and the need for species discrimination has effectively been eliminated. M.G.

N84-30420*# Agricultural Research Center, Beltsville, Md. Hydrology Lab.

COMPARISON OF THE INFORMATION CONTENT OF DATA FROM THE LANDSAT-4 THEMATIC MAPPER AND THE MULTISPECTRAL SCANNER Abstract Only

J. C. PRICE /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 128 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Simultaneous data acquisition by the LANDSAT-4 Thematic Mapper (TM) and the multispectral scanner (MSS) permits the comparison of the two types of image data with respect to engineering performance and data applications. The information contained in five matching scenes in agricultural areas is evaluated for the visible and near-IR channels, leading to the conclusion that the TM provides a significant advance in information gathering capability as expressed in terms of either bits per pixel or bits per unit area. M.G.

N84-30422*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THEMATIC MAPPER DATA QUALITY AND PERFORMANCE ASSESSMENT IN RENEWABLE RESOURCES/AGRICULTURE REMOTE SENSING Abstract Only

R. M. BIZZELL and H. L. PRIOR /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 133-134 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

It is believed that the increased spatial resolution will provide solutions to proportion estimation error due to mixed pixels, and the increased spectral resolution will provide for the identification of important agricultural features such as crop stage, and condition. The results of analyses conducted relative to these hypothesis from sample segments extracted from the 4-band Detroit scene and the 7-band Mississippi County, Arkansas engineering test scene are described. Several studies were conducted to evaluate the geometric and radiometric performance of the TM to determine data viability for the more pertinent investigations of TM utility. In most cases this requirement was more than sufficiently satisfied. This allowed the opportunity to take advantage of detailed ground observations for several of the sample segments to assess class separability and detection of other important features with TM. The results presented regarding these TM characteristics show that not only is the increased definition of the within scene variance captured by the increased spatial and spectral resolution, but that the mid-IR bands (5 and 7) are necessary for optimum crop type classification. Both qualitative and quantitative results are presented that describe the improvements gained with the TM both relative to the MSS and on its own merit. M.G.

N84-30424*# Delaware Univ., Newark. Coll. of Marine Studies. **PARAMETRIC AND NONPARAMETRIC ANALYSIS OF LANDSAT TM AND MSS IMAGERY FOR DETECTING SUBMERGED PLANT COMMUNITIES**

S. G. ACKLESON and V. KLEMAS /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 137-140 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

The spatial, spectral and radiometric characteristics of LANDSAT TM and MSS imagery for detecting submerged aquatic vegetation are assessed. The problem is approached from two perspectives; purely stochastic or nonparametric in a radiative sense and theoretical in which radiative transfer equations are used to predict upwelling radiance at satellite altitude. The spectral and radiometric aspects of the theoretical approach are addressed with which a submerged plant canopy is distinguished from a surrounding bottom of sand or mud. M.G.

N84-30427*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRELIMINARY EVALUATION OF TM FOR SOILS INFORMATION Abstract Only

D. R. THOMPSON, K. E. HENDERSON, A. G. HOUSTON, and D. E. PITTS /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 148 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08M

Thematic mapper data acquired over Mississippi County, Arkansas, were examined for utility in separating soil associations within generally level alluvium deposited by the Mississippi River. The 0.76 to 0.90 micron (Band 4) and the 1.55 to 1.75 micron (Band 5) were found to separate the different soil associations fairly well when compared to the USDA-SCS general soil map. The thermal channel also appeared to provide information at this level. A detailed soil survey was available at the field level along with ground observations of crop type, plant height, percent cover and growth stage. Soils within the fields ranged from uniform to soils that occur as patches of sand that stand out strongly against the intermingled areas of dark soil. Examination of the digital values of individual TM bands at the field level indicates that the influence of the soil is greater in TM than it was in MSS bands. The TM appears to provide greater detail of within field variability caused

by soils than MSS and thus should provide improved information relating to crop and soil properties. However, this soil influence may cause crop identification classification procedures to have to account for the soil in their algorithms. M.G.

N84-30439*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FOREST ENVIRONMENTS

P. ZINKE *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A18-A20 Aug. 1984

Avail: NTIS HC A04/MF A01 CSCL 02F

The application of remote sensing measurement techniques to scientific questions involving forests is a necessity because of the extent of forests, their variability, and the need to measure their interaction with environmental processes. The synoptic view given by remote sensing data of the extent, variability, and relation to environmental processes involving energy balances, disposition of water, and tree growth in relation to elemental storage of carbon, nitrogen and other essential elements is essential to understanding the forest in a scientific way. The ability to make comparisons in these properties at various intervals allows the determination of process functions and rates where the forest affects environmental properties. The ultimate objective in using these data is to define the extent of the forest and wildland resource, to determine the changes that are occurring in the resource due to utilization by man under conditions of changing market and population demands, and to evaluate the correlated changes occurring in various environmental properties influenced by forest vegetation on a local as well as global scale. Author

N84-30474*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOIL MOISTURE FROM TEMPERATURE MEASUREMENTS AT THE EARTH'S SURFACE, UPDATE

J. E. WELKER *In its* Res. Activities of the Geodyn. Branch 6 p Jun. 1984 refs

Avail: NTIS HC A06/MF A01 CSCL 08M

Soil moisture budgets at the Earth's surface were investigated based on soil and atmospheric temperature variations. A number of data sets were plotted and statistically analyzed in order to accentuate the existence and the characteristics of mesoscale soil temperature extrema variations and their relations to other parameters. The correlations between diurnal temperature extrema for air and soil in drought and non-drought periods appear to follow different characteristic patterns, allowing an inference of soil moisture content from temperature data. The recovery of temperature extrema after a precipitation event also follows a characteristic power curve rise between two limiting values which is an indicator of evaporation rates. If these indicators are applied universally to regional temperature data, soil moisture content or drought conditions can be inferred directly from temperature measurements. R.S.F.

N84-31740*# California Univ., Santa Barbara. Dept. of Environmental Studies.

HABITABILITY OF THE EARTH Final Report

D. B. BOTKIN, Principal Investigator and K. D. WOODS *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 13 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

Test methods to measure land vegetation biomass, net biological production and leaf area index by remote sensing are applied to estimate the biomass and net biological productivity of selected biomes, including the boreal forests and north temperate grasslands. Field verification is conducted in conjunction with remote sensing of pertinent variables and the development of a data base of relevant material initiated. Measurements are made in the Superior National Forest, Minnesota with the following remote sensing instruments: (1) an airborne 8 band Barnes radiometer; (2) the thematic mapper simulator flown in a NASA C-130 aircraft; (3) MSS data from LANDSAT 3; and (4) AVHRR data from the NOAA Satellite. Vegetation data collected as field verification in the Superior National Forest is summarized. M.A.C.

N84-31744*# California Univ., Santa Barbara.

KNOWLEDGE-BASED EXPERT SYSTEMS FOR CROP IDENTIFICATION

T. R. SMITH, J. E. ESTES, Principal Investigators, C. T. SAILER, and L. R. TINNEY (Edgerton, Germeshausen and Grier, Las Vegas, Nev.) *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 4 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 02C

The development of an improved understanding of the interactive man machine environment is investigated. In such an environment, as many feature inputs as practical would be automatically derived from a data base and input into an expert system decision making procedure. This procedure could then provide expert assistance to a trained image analyst to upgrade and improve the quantity and accuracy of the information extracted from the input data. A comparison of the similarities and differences between manual and automated image interpretation techniques is also examined. M.A.C.

N84-32967# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE SEVERITY OF THE BRAZILIAN FREEZE OF 1981 AS MONITORED IN REAL TIME BY SATELLITE

M. A. FORTUNE Nov. 1982 13 p refs In PORTUGUESE; ENGLISH summary Presented at the 2nd Brazilian Congr. on Meteorology, Pelota, Brazil, 1982

(INPE-2586-PRE/234) Avail: NTIS HC A02/MF A01

The freeze of 20-21 July 1981 destroyed most of the coffee harvest in 3 states of Brazil. With SMS/GOES satellite images it was possible to locate and monitor the areas of severest cold in real time on television displays. The ground temperature field seen on the enhanced infrared images was compared with station observations. The images presented here document the widespread occurrence of subzero temperatures in the states of Minas Gerais, Mato Grosso do Sul and Sao Paulo. The freeze struck particularly hard north of the Tropic of Capricorn, where such events are rare; thus the losses to agriculture were substantial. Author

N84-33854# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

IRRIGATED LANDS: MONITORING BY REMOTE SENSING [AREAS IRRIGADAS: MONITORAMENTO POR SENSORIAMENTO REMOTO]

J. C. N. EPIPHANIO and I. VITORELLI Aug. 1983 21 p refs In PORTUGUESE Submitted for publication

(NASA-CR-173945; NAS 1.26:173945; INPE-2852-PRE/392)

Avail: NTIS HC A02/MF A01 CSCL 08B

The use of remote sensing for irrigated areas, especially in the region of Guaira, Brazil (state of Sao Paulo), is examined. Major principles of utilizing LANDSAT data for the detection and mapping of irrigated lands are discussed. In addition, initial results obtained by computer processing of digital data, use of MSS (Multispectral Scanner System)/LANDSAT products, and the availability of new remote sensing products are highlighted. Future activities include the launching of the TM (Thematic Mapper)/LANDSAT 4 with 30 meters of resolution and SPOT (Système Probatoire d'Observation de la Terre) with 10 to 20 meters of resolution, to be operational in 1984 and 1986 respectively. Transl. by B.G.

01 AGRICULTURE AND FORESTRY

N84-33855*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

FORESTRY INVENTORY BASED ON MULTISTAGE SAMPLING WITH PROBABILITY PROPORTIONAL TO SIZE [INVENTARIO DE FLORESTA PLANTADA ATRAVES DE AMOSTRAGEM EM MULTIPLO ESTAGIO COM PROBABILIDADE PROPORCIONAL A GRANDEZA]

D. C. L. LEE, P. HERNANDEZ, JR., and Y. E. SHIMABUKURO
Sep. 1983 36 p refs In PORTUGUESE Sponsored by NASA.
Goddard Space Flight Center

(NAS 1.26:173947; NASA-CR-173947; INPE-2869-RPE/441)

Avail: NTIS HC A03/MF A01

A multistage sampling technique, with probability proportional to size, is developed for a forest volume inventory using remote sensing data. The LANDSAT data, Panchromatic aerial photographs, and field data are collected. Based on age and homogeneity, pine and eucalyptus classes are identified. Selection of tertiary sampling units is made through aerial photographs to minimize field work. The sampling errors for eucalyptus and pine ranged from 8.34 to 21.89 percent and from 7.18 to 8.60 percent, respectively. M.A.C.

N84-33874# Minnesota Univ., St. Paul. Dept. of Soil Science.
CHANGES IN TM RESPONSE OF SOIL SCENES DUE TO TILLAGE, RESIDUE, AND WEATHERING

M. SEELEY, E. LARSON, C. SCHRADER, and D. LINDEN
(Agricultural Research Service, St. Paul, Minn.) In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 107-110 Aug. 1984 refs Sponsored by USDA

Avail: NTIS HC A24/MF A01

In order to determine how LANDSAT Thematic Mapper (TM) spectral response for a single soil type varies with alternative tillage and crop residue management strategies, changes in spectral response of a Waukegan silt loam soil were induced by variable tillage and crop residue management on replicated plots. Variable random roughness has little effect. Differential weathering of these soil surfaces is spectrally evident over time. Crop residue type and amount have significant effects on spectral response when the surface coverage exceeds 35%. Author (ESA)

N84-33875*# National Aeronautics and Space Administration.
Lyndon B. Johnson Space Center, Houston, Tex. Earth Science and Applications Div.

SPECTRAL CHARACTERIZATION OF BIOPHYSICAL CHARACTERISTICS IN A BOREAL FOREST: RELATIONSHIP BETWEEN THEMATIC MAPPER BAND REFLECTANCE AND LEAF AREA INDEX FOR ASPEN

G. BADHWAR, R. B. MACDONALD, F. G. HALL, and J. G. CARNES In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 111-115 Aug. 1984 refs

Avail: NTIS HC A24/MF A01 CSCL 05B

Results from analysis of a data set of simultaneous measurements of Thematic Mapper band reflectance and leaf area index are presented. The measurements were made over pure stands of Aspen in the Superior National Forest of northern Minnesota. The analysis indicates that the reflectance may be sensitive to the leaf area index of the Aspen early in the season. The sensitivity disappears as the season progresses. Based on the results of model calculations, an explanation for the observed relationship is developed. The model calculations indicate that the sensitivity of the reflectance to the Aspen overstory depends on the amount of understorey present. Author (ESA)

N84-33876# Kansas Univ. Center for Research, Inc., Lawrence. Lab. of Remote Sensing.

MODELING THE POLARIZATION DEPENDENCE OF THE ATTENUATION IN VEGETATION CANOPIES

C. T. ALLEN and F. T. ULABY In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 119-124 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

A model for computing the loss-factor of a vegetation canopy was developed. It assumes that the leaves may be treated as

randomly distributed disks, and that the stalks are vertical cylinders. The vertical structure of the stalks leads to a strong polarization dependence, as predicted by the model and supported by experimental observations. Loss measurements made at 10.2 GHz for wheat and soybean canopies are compared to model calculations. The geometry of the stalks in a wheat canopy results in a polarization-dependent absorption coefficient that varies by two or more orders of magnitude, depending upon the choice of polarization, frequency, and incidence angle, as well as upon the prevailing canopy conditions. A similar, though less dynamic, behavior is seen in the wheat-head absorption coefficient. Due to the random nature of leaf distribution in the soybean canopy, no polarization dependence is seen. Author (ESA)

N84-33878*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

PARAMETRIC ANALYSIS OF SYNTHETIC APERTURE RADAR DATA ACQUIRED OVER TRUCK GARDEN VEGETATION

S. T. WU In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 131-135 Aug. 1984 refs Sponsored by Bundesministerium fuer Forschung und Technologie and DVFLR Original contains color illustrations

Avail: NTIS HC A24/MF A01 CSCL 05B

An airborne X-band SAR acquired multipolarization and multiflight pass SAR images over a truck garden vegetation area. Based on a variety of land cover and row crop direction variations, the vertical (VV) polarization data contain the highest contrast, while cross polarization contains the least. When the radar flight path is parallel to the row direction, both horizontal (HH) and VV polarization data contain very high return which masks out the specific land cover that forms the row structure. Cross polarization data are not that sensitive to row orientation. The inclusion of like and cross polarization data help delineate special surface features (e.g., row crop against non-row-oriented land cover, very-rough-surface against highly row-oriented surface). Author (ESA)

N84-33879# Technische Univ., Freising (West Germany). Lehrstuhl fuer Pflanzenbau und -zuechtung.

THE X, AND L-BAND RADAR BACKSCATTERER ANALYSIS OF AGRICULTURAL CROPS IN WEST GERMANY

H. ERNST and G. FISCHBECK In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 137-140 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Dual like-polarized X and L-band agricultural test site data were digitally recorded, processed and analyzed by using an interactive image analysis system. Mean gray levels from sugar beet, potatoes, wheat and barley fields were computed and compared to a comprehensive set of ground truth information. The data indicate surface scattering from cereal fields, but even L-band waves are influenced by the phytomass density in the ear region of wheat cultivars and barley. Absorption of longer waves by the canopy increases with canopy moisture content, especially at vertical polarization. Root crops show the highest radar return in both frequencies. Percent soil cover and row direction of potato fields influence radar backscatter only at longer wavelengths. Otherwise soil surface does not affect radar return. Author (ESA)

N84-33880# Wageningen Agricultural Univ. (Netherlands). Dept. of Landsurveying and Remote Sensing.

RADAR BACKSCATTERING OF FOREST STANDS

D. H. HOEKMAN In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 141-148 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Results of four X-band SLAR-flights are analysed. The digital radar images obtained are accurately corrected both geometrically and radiometrically and indicate gamma values instead of arbitrary arbitrary graytones. Radar signatures of 16 classes of forest stands were derived from these images showing seasonal and angular effects. Phenomena observed indicate effects of vegetation structure on radar backscattering. Results demonstrate the

appropriateness of X-band in the classification of (Dutch) forests. A classification simulation yields overall error fractions ranging from 10% to 16% at a polder test area and 14% to 28% at another test area. This can be demonstrated in multitemporal radar images as well as in actual classified images. Author (ESA)

N84-33881*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
USE OF MULTI-FREQUENCY, MULTI-POLARIZATION, MULTI-ANGLE AIRBORNE RADARS FOR CLASS DISCRIMINATION IN A SOUTHERN TEMPERATURE FOREST
 N. C. MEHTA *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 149-154 Aug. 1984 refs

Avail: NTIS HC A24/MF A01 CSCL 05B

The utility of radar scatterometers for discrimination and characterization of natural vegetation was investigated. Backscatter measurements were acquired with airborne multi-frequency, multi-polarization, multi-angle radar scatterometers over a test site in a southern temperate forest. Separability between ground cover classes was studied using a two-class separability measure. Very good separability is achieved between most classes. Longer wavelength is useful in separating trees from non-tree classes, while shorter wavelength and cross polarization are helpful for discrimination among tree classes. Using the maximum likelihood classifier, 50% overall classification accuracy is achieved using a single, short-wavelength scatterometer channel. Addition of multiple incidence angles and another radar band improves classification accuracy by 20% and 50%, respectively, over the single channel accuracy. Incorporation of a third radar band seems redundant for vegetation classification. Vertical transmit polarization is critically important for all classes. Author (ESA)

N84-33887# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

AUTOMATIC ANALYSIS OF BITEMPORAL LANDSAT DATA: AN APPLICATION TO THE STUDY OF THE EVOLUTION OF VEGETATION-COVERED AREAS IN A TROPICAL REGION

D. DUCROS-GAMBART and J. P. GASTELLU-ETCHEGORRY *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 187-192 Aug. 1984 refs Prepared in cooperation with CNRS, Toulouse and Toulouse Univ. Original contains color illustrations

Avail: NTIS HC A24/MF A01

An automatic procedure to study the evolution of tropical vegetation types between two dates is presented. A multidimensional supervised classification (spectral and textural) is carried out separately for the two dates. The textural information is introduced to overcome constraints due to the low dynamic range of the spectral values which made it difficult to separate different landscape units. A geometrical correction program which allows the superposition of the two images is applied. Regions studied have few reference points, due to fuzzy contours between the vegetation types: the program cannot be used in an optimal fashion. The algorithm allows a distinction between the differences due to the evolution of the landscape and those due to the positioning errors which remain in the corrected image. The percentages of the pixels which change between the two dates for the classes chosen and a map of this change are given.

Author (ESA)

N84-33891*# National Aeronautics and Space Administration, Washington, D. C. Land Processes Branch.

AN ANALYSIS OF THE EFFECT OF BIOLOGICAL AND PHYSICAL PARAMETERS OF A WETLANDS GRASS BIOME ON THE SPECTRAL MODELING OF PHYTOMASS AND PRIMARY PRODUCTIVITY

M. K. BUTERA and A. FRICK *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 209-216 Aug. 1984 refs

Avail: NTIS HC A24/MF A01 CSCL 05B

Aircraft simulated thematic mapper data and field data were acquired in the fall and spring to analyze the relationship of spectral

response and biomass for the marsh grass *Spartina patens*. Regression results indicate no simple relationship exists for TMS spectral response and biomass with a high R^2 . However, results show a consistent relationship between spectral response and the percent live vegetation (by weight) and percent interstitial standing surface water (by area) as independent variables. It is suggested that the reflected energy of a pixel represents a mixture of surface constituents. It is recommended that alternative remote sensors be employed to account for the pixel constituents of live and dead vegetation, litter, and standing water. Author (ESA)

N84-33892# Freiburg Univ. (West Germany). Abteilung Luftbildmessung und Fernerkundung.

INVESTIGATION OF SPECTRAL SIGNATURES OF DIFFERENTLY DAMAGED TREES AND FOREST STANDS

A. KADRO *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 217-221 Aug. 1984 refs Original contains color illustrations

Avail: NTIS HC A24/MF A01

The spectral reflection behavior of forest vegetation, especially the difference between healthy and damaged trees and stands, was investigated using visual, near infrared, and middle infrared data collected from different flight altitudes. A computer aided classification method for forest stand damage inventory was derived. Spectral signatures show clear differences between healthy and damaged trees. The computer classification scheme is substantiated by subjective photointerpretation, but it misclassifies beech as healthy fir or spruce. Author (ESA)

N84-33893# Indian Space Research Organization, Bangalore.
AN APPROACH FOR AGRICULTURAL DROUGHT MONITORING USING NOAA/AVHRR AND LANDSAT IMAGERY

P. P. N. RAO and V. R. RAO *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 225-229 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

An approach for preparing an indicative drought map showing the areas of high probability of drought based on rainfall estimation at the seedling stage of crop growth using NOAA/AVHRR imagery is discussed. The indicative drought map can be used for initiating relief measures early in the crop growing season. The AVHRR band 3 (3.55 to 3.93 microns) is useful in delineating broad categories of drought affected areas. Severity of the drought affect between two different regions was assessed using LANDSAT imagery. This approach was tried for the drought year 1982 in the Southern peninsular part of India. Good correlation between satellite rainfall estimates and ground observations is reported.

Author (ESA)

N84-33896# Canada Centre for Remote Sensing, Ottawa (Ontario).

ON THE SAR RESPONSE OF AGRICULTURAL TARGETS IN A NORTHERN PRAIRIE ENVIRONMENT

J. CIHLAR and T. HIROSE (FG Bercha and Associates, Ltd.) *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 241-249 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Relationships between SAR backscatter and parameters describing agricultural cover types in a northern prairie environment were studied, and digital classification accuracies for these types derived from individual pixel values were compared to those derived from mean field intensities. Single date digital airborne X and L-band data, SEASAT data, and LANDSAT MSS data were analyzed for four agricultural sites. Results indicate the importance of cover type for determining SAR backscatter and the ability of SAR data to accurately separate cover types. Classification employing field means yields higher overall accuracies. However, it is not possible to consistently relate SAR image tone to target parameters, partly due to limitations of supporting data. Author (ESA)

N84-33897*# Coast Guard, Washington, D.C. Office of Research and Development.

CORRELATION OF MICROWAVE SENSOR RETURNS WITH SOIL MOISTURE

D. W. TAUBE and S. W. THEIS (Technology Service Corp., Silver Spring, Md.) *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 251-256 Aug. 1984 refs Sponsored by US Geological Service and USDA (Contract NSG-5134; MO-A01-004332)

Avail: NTIS HC A24/MF A01 CSCL 08M

Microwave sensor soil data were collected by aircraft over agricultural croplands. Multiple incident angle scatterometer data (13.3, 4.75, 1.6 and 0.4 GHz), passive radiometer data (L and C-band), and soil moisture ground truth measurements were collected coincidentally. Each sensor and angle of incidence was linearly analyzed against the measured soil moisture. For bare agricultural soils, the optimal single sensor for soil moisture prediction is the L-band passive radiometer. The effects of vegetation and differing surface roughness prove significant. When both bare and vegetated surfaces were studied, the masking due to the vegetation renders the single sensor approach ineffective in soil moisture prediction. Multisensor techniques are necessary to remotely measure soil moisture when a priori knowledge of vegetation is not available. Author (ESA)

N84-33898*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

UTILIZATION OF ACTIVE MICROWAVE ROUGHNESS MEASUREMENTS TO IMPROVE PASSIVE MICROWAVE SOIL MOISTURE ESTIMATES OVER BARE SOILS

S. W. THEIS (Technology Service Corp., Silver Spring, Md.), B. J. BLANCHARD, and A. J. BLANCHARD (Texas University, Arlington) *In* ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 257-262 Aug. 1984 refs Sponsored by US Geological Service and USDA (Contract NSG-5134; MO-A01-004332)

Avail: NTIS HC A24/MF A01 CSCL 08M

Multisensor aircraft data were used to establish the potential of the active microwave sensor response to be used to compensate for roughness in the passive microwave sensor's response to soil moisture. Only bare fields were used. It is found that the L-band radiometer's capability to estimate soil moisture significantly improves when surface roughness is accounted for with the scatterometers. Author (ESA)

N84-35042# National Central Univ., Chung-Li (Taiwan).

A STUDY OF MULTISPECTRAL MODEL OF LAND COVER Abstract Only

H. T. WANG and J. J. CHEN *In* National Science Council Sci. Res. Abstr. in Republic of China, 1983 p 9 Jun. 1984

Avail: Issuing Activity

Airborne multi-spectral scanner data was used to estimate the acreage of the rice paddy, the most important crop in Taiwan. The bidirectional reflectance of the rice paddy was measured using two GSFC/Mark II three band radiometers. The preliminary results show that, for TM4 and TM5 bands, the reflectance exhibits a strong dependence on observed and solar zenith angles. For a fixed solar zenith angle, the reflectance is larger for large vertical view angle, i.e., a V-shaped distribution. Thus, a complete understanding of the bi-directional reflectance distribution function, (BRDF), is needed to better utilize the airborne Mss data (note that the scanning range of our Daedalus 1260 scanner is about 80 deg). A Monte Carlo model was proposed to simulate the radiation-rice paddy interaction. Results show: (1) for a given growing stage and each photon incident angle, about 100,000 photons are needed to get statistical meaningful BRDF. (2) The V shape phenomena was correctly predicted, and (3) the simulated results agree quite well with measured data. R.J.F.

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

A84-39787

USE OF SMALL FORMAT AERIAL PHOTOGRAPHY FOR LAND USE MAPPING AND RESOURCE MONITORING

A. KILLMAYER and H. EPP (Kenya Rangeland Ecological Monitoring Unit, Nairobi, Kenya) *ITC Journal* (ISSN 0303-2434), no. 4, 1983, p. 285-290. refs

A84-39788

PHOTOGRAMMETRIC APPLICATIONS IN SURVEYS OF CULTURAL PROPERTY

T. ITOH (Nara National Cultural Properties Research Institute, Nara, Japan) *ITC Journal* (ISSN 0303-2434), no. 4, 1983, p. 302-306.

Photogrammetrists in Japan have spent a number of years developing and testing photographic techniques for accurately recording details of archeological sites and preparing detailed drawings for restoration projects. An ingenious assortment of camera platforms have been used, some more successfully than others. Author

A84-39789

LANDSCAPE CONCEPT AND LANDSCAPE AND RANGELAND SURVEYS IN THE SOVIET UNION

B. PEDROLI (Amsterdam, Universiteit, Amsterdam, Netherlands) *ITC Journal* (ISSN 0303-2434), no. 4, 1983, p. 307-321. refs

The use of landscape concepts in landscape surveys and studies in the Soviet Union is reviewed, with special attention to hierarchies in landscape terminology. The importance of rangeland in Soviet agriculture is reflected in a large number of rangeland classification systems. The application of the so-called 'landscape approach' in surveying rangelands is discussed, including the use of remote sensing techniques. Author

A84-39942

ON THE USE OF GOES THERMAL DATA TO STUDY EFFECTS OF LAND USE ON DIURNAL TEMPERATURE FLUCTUATION

S. F. SHIH and E. CHEN (Florida, University, Gainesville, FL) *Journal of Climate and Applied Meteorology* (ISSN 0733-3021), vol. 23, March 1984, p. 426-433. refs

Geostationary Operational Environmental Satellite (GOES) infrared data were used to study the effect of land use on the diurnal surface temperature fluctuation. Five major land use types in southern Florida: the sandy soil agricultural area; the Everglades Agricultural Area (EAA); the conservation areas; the Natural Everglades Area (NEA); and Lake Okeechobee; were observed. The average daytime and nocturnal surface temperatures of sandy soil in agricultural areas was lower than that of organic soil in agricultural areas. The average temperature of organic soil in agricultural areas was lower than that of organic soil in conservation areas. The surface temperature in the wet marsh area was much lower than that in a large water-storage lake. A land use change in the EAA, and an increase in the water storage in Lake Okeechobee and the conservation areas could influence the microclimate. Author

A84-40151

PAPERS SELECTED FOR PRESENTATION AT THE SIXTEENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT. VOLUMES 1 & 2

Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, Vol. 1, 601 p.; vol. 2, 496 p.

Various papers on remote sensing of the environment are presented. The topics of discussion include the development of

remote sensing techniques and methodology and the effective utilization of remote sensing technology in various application areas such as agriculture, geology, hydrology, land and cultural resources, meteorology, and oceanography. C.D.

A84-40152#

REMOTE SENSING APPLICATIONS IN MEXICO

J. A. DIEZ PEREZ (Secretaria de Agricultura y Recursos Hidraulicos, Subdireccion de Investigacion y Tecnologia de Apoyo, Mexico City, Mexico) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 1-13. refs

Past and present remote sensing projects in Mexico are reviewed. The results of Mission 91, a 1968 remote sensing project with the United States, are summarized, as are the results of remote sensing studies performed by airplane. Satellite investigations are reviewed, and advances in the use of computers in Mexican remote sensing are discussed. Recent developments in Mexican remote sensing are described, and the main problems in its future development are cited. It is concluded that Mexico requires a national program of remote sensing coordinated by a single institution. C.D.

A84-40153#

USE OF LANDSAT IMAGES IN INTEGRATED NATURAL RESOURCE SURVEYS IN BOLIVIA

A. PEREZ V. IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 15-23.

The results of CSIRO remote sensing projects covering Bolivia and using Landsat imagery are discussed. The physiographic regions of Bolivian territory are described, and the CSIRO methodology for studying this territory by remote sensing is summarized. A recent remote sensing study of Bolivia's resources is briefly described, and its results are summarized. It is concluded that the studies were successful, in that they covered about 82 percent of Bolivian territory, leading to an accurate estimate of the potential and possible distribution of natural resources in the country. C.D.

A84-40154#

MAIN ADVANCES AND NEEDS IN CHILEAN REMOTE SENSING PROGRAMS

M. ARAYA F. (Universidad de Chile, Santiago, Chile) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 25-42. refs

Problems and progress in Chilean remote sensing are discussed, citing existing facilities and past accomplishments as well as present needs and planned projects. The problem of data acquisition is addressed in terms of the spatial, aerial, and terrestrial observation levels normally used in remote sensing techniques. Data preprocessing and interpretation and technology transference are briefly considered. Current projects in the areas of agriculture, forestry, land use, geology and mineral resources, cartography, oceanography and meteorology, Antarctic resources and environmental conditions, snow-water and geothermal resources in the Andes range, and civil engineering problems such as environmental pollution and urban traffic are described. C.D.

A84-40155#

THE COLOMBIAN REMOTE SENSING PROGRAM

H. RIVERA H. (Centro Interamericano de Fotointerpretacion, Bogota, Colombia) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 43-58.

The use of remote sensing to evaluate natural resources in Colombia is described. The results of Colombian remote sensing programs over the last ten years are summarized, the present

situation is shown and short-range plans and projects are considered. Applications of remote sensing techniques in Colombia are listed, and the objectives, functions, structure, resources, experiences, and publications of the central Colombian remote sensing agency are given. The relationship of the agency's program to other national development plans and its cooperation with agencies of other countries is addressed. Finally, the Colombian remote sensing program's objectives, organization, budget, and justification are presented in outline form. C.D.

A84-40161#

THE USE OF SATELLITE DATA FOR URBAN MONITORING IN THE SAO PAULO METROPOLITAN AREA

M. A. LOMBARDO, G. CAMARA, A. E. COSTA PEREIRA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil), and J. R. TARIFA (Sao Paulo, Universidade, Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 119-121.

The use of Landsat images to study the growth of the urban area of Sao Paulo, Brazil, and the heat island over the city is discussed. The results of Niero et al. (1982) and Lombardo et al. (1982) are summarized, and the cost advantage of using satellite images rather than in situ measurement is stressed. T.K.

A84-40180#

DISCRIMINATION BETWEEN RANGELAND PASTURE COMMUNITIES IN THE NORTH-WEST OF AUSTRALIA USING LANDSAT DATA

N. A. CAMPBELL, F. R. HONEY, I. J. TAPLEY (Commonwealth Scientific and Industrial Research Organization, Wembley, Australia), D. G. BURNSIDE (Department of Agriculture, Kalgoorlie, Australia), and W. F. HOLMAN (Department of Lands and Surveys, Perth, Australia) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 343-353. refs

A84-40182#

STUDIES ON SOME URBAN PROBLEMS BY USING AIRBORNE REMOTE SENSORS IN SANTIAGO, CHILE

M. ARAYA F., J. GIBSON, R. FERNANDEZ, and N. NUSSBAUM (Universidad de Chile, Santiago, Chile) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 365-379.

A84-40190#

LANDSAT-RELATED STUDY FOR THE MALI LAND USE INVENTORY IN WEST AFRICA

C. S. BINGHAM, D. THOM (Tippett-Abbott-McCarthy-Stratton, New York, NY), and S. BOUARE (Ministry of Rural Development, Mali). (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 481-490.

The mapping techniques used in the Mali Land and Water Resources Atlas (1982) are discussed and demonstrated. Data were derived from Landsat false-color and channel-7 images, aerial photography, and extensive field verification. The characteristics of land use and population distribution in Mali are shown to require sophisticated mapping and legend-writing procedures based on land-use types, site types, and distribution and density criteria (in addition to the standard crop and livestock symbols), and a circle-legend technique for population. A detailed description of the mapsheet for the Mopti region is included. T.K.

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

A84-40202#

CONSTRUCTION OF A DYNAMIC MODEL OF LAND USE/LAND COVER FROM SEQUENTIAL REMOTE SENSING DATA

M. K. NOSSEIR (Superintendencia de Recursos Naturais e Meio Ambiente, Rio de Janeiro, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 629-636. refs

The present investigation is concerned with the development of a quantitative method for monitoring land use changes on the basis of sequential aerial photographs, taking into account also the construction of a dynamic model regarding these changes. The site considered is a 14 km by 4 km area located in the Kanamha section of Hocking county, south-eastern Ohio. Aerial photographs are used in five sets corresponding to 1938, 1952, 1958, 1966, and 1976. The 16 land use classes are grouped into five categories, including forests, grassland, agricultural land, mines, and others. A discretization procedure is employed to divide the site into 56 equal size cells (1 km by 1 km). G.R.

A84-40212#

DEVELOPMENT OF A REMOTE SENSING-AIDED DIGITAL DATABANK FOR LARGE SCALE LAND USE PLANNING

S. KHORRAM (North Carolina State University, Raleigh, NC) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 749-759. refs

The increase in population in California and the resulting pressure on existing resources make it desirable to obtain accurate and current information on land use and land cover. The present investigation is concerned with the procedures which were used for the development and utilization of a spatially-referenced digital databank to provide the required spatial data for selection of urban development site by the Plumas County Planning Department. The investigation considers a combination of remotely-sensed data and ground-acquired data as a basis for the selection of a suitable site. G.R.

A84-40219#

USE OF INFRARED IMAGES IN THE DELIMITATION OF SAO PAULO'S HEAT ISLAND

M. A. LOMBARDO, G. CAMARA, E. PEREIRA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil), and J. R. TARIFA (Sao Paulo, Universidade, Sao Paulo, Brazil) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 831-838.

The objective of this work is to describe a way of using remote sensing techniques to delimit and characterize an urban heat island. The study was carried out in metropolitan Sao Paulo. One can make a thermal mapping of an urban heat island by measuring temperatures in situ or by remote sensing. Since in loco measurements in a big city require considerable experimental resources, remote sensing by satellites may be the best option when it is necessary to take extensive and repetitive measurements. The technique used in this work is similar to that used by Chahine to derive ocean temperature from infrared images. The method was used to analyze a Tiros-N (NOAA 7) image taken on July 16, 1981, at 5:47 PM. On this day, the atmospheric conditions were propitious for the formation of a heat island in Sao Paulo. Through this example, one can conclude that infrared images can be useful in the definition and characterization of an urban heat island.

Author

A84-40225#

THE USE OF LANDSAT DATA TO MONITOR THE URBAN GROWTH OF SAO PAULO METROPOLITAN AREA

M. NIERO, C. FORESTI (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil), and M. A. LOMBARDO (Sao Paulo, Universidade, Sao Paulo, Brazil) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 905-914. refs

Urban growth from 1977 to 1979 of the region between Billings and the Guarapiranga reservoir was mapped and the problematic urban areas identified using several Landsat products. Visual and automatic interpretation techniques were applied to the data. Computer compatible tapes of Landsat multispectral scanner data were analyzed through the maximum likelihood Gaussian algorithm. The feasibility of monitoring fast urban growth by remote sensing techniques for efficient urban planning and control is demonstrated. Previously announced in STAR as N82-33793 J.D.

A84-40544

THE REMOTE SENSING OF CONTAMINATED LAND

M. G. COULSON (Swansea, University College, Swansea, Wales) and E. M. BRIDGES (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 659-669. refs

The Lower Swansea Valley contained some 162 hectares of waste tips at the start of reclamation. This paper describes a project using MSS-82 airborne thematic mapper simulation data to evaluate the role of remote sensing in assessing, classifying and mapping contaminated and other surfaces. Bare surface materials are discriminated and various classes of metaliferous waste identified, notably residue from copper, zinc and iron smelting. A vegetated surface under which there was contaminated material was also identified with the aid of principal component analysis. Author

A84-41960* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN EVALUATION OF LANDSAT DATA FOR INPUT TO A STATE GEOGRAPHIC INFORMATION SYSTEM

E. M. MIDDLETON (NASA, Goddard Space Flight Center, Eastern Regional Remote Sensing Applications Center, Greenbelt, MD), B. G. BLY, III (Computer Sciences Corp., Silver Spring, MD), and J. M. GARBER (Maryland Department of State Planning, Baltimore, MD) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 83-93. refs

The results of a study to evaluate Landsat digital data, categorized by land cover, for input to the Maryland Automated Geographic Information (MAGI) system, the state georeferenced data base, are presented. Good correspondence is found between the MAGI system and Landsat data for six of seven categories: forest, water, crop/pasture, medium-density residential, low-density residential, and transitional (disturbed land, construction). Discrepancies between the results are found for commercial/industrial/institutional areas which are due to differences in interpretative methodologies, not to deficiencies in either data source. It is concluded that Landsat data are suitable for future Maryland land cover inventories, and can also be used to augment MAGI system data. C.D.

A84-41967

A STUDY OF TWO REMOTE SENSING METHODS FOR EVALUATING LAND COVER IN SOUTH CAROLINA

G. R. MINICK and D. J. COWEN (South Carolina, University, Columbia, SC) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 155-163.

General land cover derived from computer analysis and mapping of satellite-based multispectral scanner imagery and land use and land cover derived from conventional aerial photographic interpretation and mapping were analyzed for content similarity and consistency for the State of South Carolina. The primary objectives were to determine the compatibility of results generated by differing remote sensing techniques and to assess the potential value of having both data sets available in the South Carolina Natural Resource Information System (SCNRIS). Author

A84-41968

EPA'S ENVIRONMENTAL IMAGE ANALYSIS SYSTEM

D. B. CROOK and G. HOWARD, JR. (Bionetics Corp., Environmental Photographic Interpretation Center, Warrenton, VA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 165-167.

Capabilities of the Environmental Protection Agency's automated remotely sensed image processing center are described. The Image Analysis System features a minicomputer, an 80 Mbyte disk drive, a nine track tape drive, an interactive graphics station, a light table, a plotter and software. Photographic imagery can be handled at 1:1 to 1:24,000 scales and converted between scales. Cartographic data bases can be designed for particular applications through classification, storage, retrieval, annotation and editing functions. Applications include noise level maps around railroad yards, crop monitoring, identification of nonpoint source pollution and landfill inventorying. M.S.K.

A84-41976

GEOCODING OF LAND COVER DATA BY REMOTE SENSING AND MICROCOMPUTER

R. WRIGHT (Aberdeen, University, Aberdeen, Scotland) and P. G. FOSCHI (California, University, Santa Barbara, CA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 263-271. refs

A land cover classification system based on aerial photography and computer-aided image processing is described. The system was devised for 32 class land cover analysis at the rural/urban interface near Aberdeen, Scotland, and to investigate the applicability of Landsat data for the purpose. The aerial data had been gathered over a 15 yr period and varied in scale from 1:23,000 to 1:50,000. A BASIC program was devised for a microcomputer to overlay and update the data and define regions and land cover, and to discern changes that occurred over the interval. A grid cell scheme was defined to standardize image data recordings. The Landsat data were found useful for broad-area surveys. M.S.K.

A84-41977

VEGETATION AND LAND COVER MAP AND DATA FOR AN ENVIRONMENTAL IMPACT STATEMENT, ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA MULTISTAGE DEMONSTRATION OF AUTOMATION IN THEMATIC CARTOGRAPHY

J. R. WRAY (U.S. Geological Survey, Reston, VA) and L. GAYDOS (U.S. Geological Survey, Menlo Park, CA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 283-286.

The U.S. Geological Survey has published map I-1443, Vegetation and Land Cover, Arctic National Wildlife Refuge Coastal Plain, Alaska. The map was prepared in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) for an environmental impact statement in anticipation of seismic oil exploration. Production of this map is a multistage demonstration of automated thematic cartography applied in an interagency approach to a problem in 'Environmental Assessment and Resource Management', theme of the Auto-Carto 5/ISPRS IV Joint Symposium. Five stages begin with capture of spatial data in digital format and end with printing of the map and area statistical summary. A copy of the map is in the pocket inside the back cover of these proceedings. Author

A84-41990

INTEGRATED RESOURCES INVENTORY USING LANDSAT DATA

H. S. MEHTA (Institute of Technology and Science, Indore, India) and A. N. PATEL (College of Technology, Owerri, Nigeria) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 443-448.

Landsat-2 imagery has been used to inventory resources in the Indore region of Madhya Pradesh, India. The district has 654 villages and the main crop is cotton grown in black soil. Both aerial photographs and Landsat imagery (bands 5 and 7) were used. Account was taken of habitation, agriculture, forest and water body classifications. The verification of Landsat 0.6 hectare areal resolution commends the data for large area land use inventories. M.S.K.

A84-42925

THE INFORMATION REQUIREMENTS OF URBAN AND REGIONAL PLANNING CONTRIBUTION OF SPACE REMOTE SENSING TO THE SATISFACTION OF THESE NEEDS [LES BESOINS D'INFORMATION POUR L'AMENAGEMENT URBAIN ET REGIONAL - APPORT DE LA TELEDETECTION SPATIALE A LA SATISFACTION DE CES BESOINS]

A. BALLUT (Region Ile de France, Institut d'Amenagement et d'Urbanisme, France) and P. T. NGUYEN (IBM France, S.A., Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 93, 1984, p. 21-32. In French. refs

The use of satellite-remote-sensing images to characterize urban areas is discussed and illustrated. The kinds of information needed by urban planners and the traditional sources of that information are reviewed; the spectral, geometric, and topological characteristics of typical urban objects and patterns are examined; an application to the measurement of vegetation-covered area in a district (Thibault, 1983) is summarized; and the preprocessing, classification, structure-detection, classification-integration, and change-detection techniques used on simulated SPOT images to analyze seasonal changes in land use in Paris Sub-Ouest (Biancale

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and Dugeny, 1983; Laine et al., 1983) are described in detail and illustrated with block diagrams, panchromatic and false-color images, and maps. T.K.

A84-43802

THE LONG-RANGE TRAVEL AND DISPERSION OF THE PLUME FROM THE MOUNT ST HELENS VOLCANO

J. CRABTREE and M. KITCHEN (Meteorological Office, Bracknell, Berks., England) Atmospheric Environment (ISSN 0004-6981), vol. 18, no. 6, 1984, p. 1073-1079. refs

The eruption of the Mount St Helens volcano on May 18, 1980 provided a unique opportunity to study long-range transport of airborne material in the upper troposphere. Forecast trajectories indicated that the major part of the debris would reach the eastern Atlantic around 30 deg N, and the Hercules aircraft of the Meteorological Research Flight was detached to Gibraltar to take samples of the plume. The results showed that the trajectories, based on the Meteorological Office 10-level forecast model, predicted the movement of the debris quite well. There was marked horizontal and vertical structure within the plume, and evidence that some segregation of particles of different size ranges had occurred. The total flux of material in the sampled volume was estimated to be of the order of half a megatonne. Author

A84-45687* National Aeronautics and Space Administration, Washington, D. C.

GLOBAL HABITABILITY AND EARTH REMOTE SENSING

S. G. TILFORD (NASA, Earth Science and Applications Div., Washington, DC) (Royal Society, Discussion on Technology in the 1990s: The Industrialization of Space, London, England, Dec. 7, 8, 1983) Royal Society (London), Philosophical Transactions, Series A (ISSN 0080-4614), vol. 312, no. 1519, July 26, 1984, p. 115-118.

Since 1960, when NASA launched the Tiros satellite to study the atmosphere of the earth, great advances have been made in the study of the earth system by means of remote sensing. It is felt that the time has come for assembling the separate pieces into a coherent whole. Work has, therefore, been conducted to develop a concept called 'global habitability'. The objective of the considered program is to investigate long-term physical, chemical, and biological trends and changes in the earth's environment, including its atmosphere, land masses, and oceans. The program is specifically concerned with a study of the effects of natural and human activities on the earth's environment, and with the future effects on biological productivity and habitability of the earth by man and by other species. G.R.

A84-48752

AEROSPACE MONITORING OF ECOSYSTEMS [AEROKOSMICHESKII MONITORING EKOSISTEM]

B. V. VINOGRADOV Moscow, Izdatel'stvo Nauka, 1984, 320 p. In Russian. refs

Some general trends in the development of remote sensing techniques for monitoring and surveying earth resources are discussed. After a brief description of current remote sensing technology and its information processing components, attention is given to several applications of the technology including monitoring of vegetation, soil, wildlife, and climate. Mapping and monitoring of the structural aspects of the ecosystem and the geophysical effects of anthropogenic changes in the ecosystem are also considered. Several sample photographs of remotely sensed features of the earth's surface are presented. I.H.

A84-49143#

APPLICATIONS OF METSAT DATA IN LAND REMOTE SENSING

G. OHRING, M. MATSON, D. F. MCGINNIS, JR., and S. R. SCHNEIDER (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) IN: Satellite land remote sensing advancements for the eighties, Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 173-186. refs

It is pointed out that polar-orbiting and geostationary meteorological satellite data are used to monitor many parameters related to agriculture, hydrology, glaciology, volcanology, and land use. The polar-orbiting satellites (NOAA series) are useful for land surface applications because of their multispectral capability and their global coverage. The geostationary satellites provide continuous observation of the Western Hemisphere between 55 deg N and 55 deg S. A description is given of case studies which document the use of these satellite systems for studying selected land surface parameters. Attention is given to the vegetation index, insolation, the river basin snow cover, continental snow cover, flood extent mapping, river ice, glaciology, volcanology, urban heat islands, fire detection and deforestation, and future land studies applications of meteorological satellite data. G.R.

N84-30421*# Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.

STUDY OF THEMATIC MAPPER AND MULTISPECTRAL SCANNER DATA APPLICATIONS

F. G. SADOWSKI, R. H. HAAS, J. A. STURDEVANT, W. H. ANDERSON, P. M. SEEVERS, J. W. FEUQUAY, L. K. BALICK, F. A. WALTZ, and D. T. LAUER (EROS Data Center, Sioux Falls, S. Dak.) IN: NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p. 129-132 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 14B

The U.S. Geological Survey EROS Data Center evaluated the utility of LANDSAT multispectral scanner (MSS) and Thematic Mapper (TM) data for natural resource assessment and land cover information, emphasizing manual interpretation and digital classification of the data for U.S. Department of the Interior applications. In most cases, substantially more information was derived from TM data than from MSS data. The test areas included Washington, D.C. and prairie regions of South Dakota and Kansas. M.G.

N84-30423*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

PRELIMINARY COMPARISONS OF THE INFORMATION CONTENT AND UTILITY OF TM VERSUS MSS DATA Abstract Only

B. L. MARKHAM IN: LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p. 135-136 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Comparisons were made between subscenes from the first TM scene acquired of the Washington, D.C. area and a MSS scene acquired approximately one year earlier. Three types of analyses were conducted to compare TM and MSS data: a water body analysis, a principal components analysis and a spectral clustering analysis. The water body analysis compared the capability of the TM to the MSS for detecting small uniform targets. Of the 59 ponds located on aerial photographs 34 (58%) were detected by the TM with six commission errors (15%) and 13 (22%) were detected by the MSS with three commission errors (19%). The smallest water body detected by the TM was 16 meters; the smallest detected by the MSS was 40 meters. For the principal components analysis, means and covariance matrices were calculated for each subscene, and principal components images generated and characterized. In the spectral clustering comparison each scene was independently clustered and the clusters were assigned to informational classes. The preliminary comparison indicated that TM data provides enhancements over MSS in terms of (1) small target detection and (2) data dimensionality (even

with 4-band data). The extra dimension, partially resultant from TM band 1, appears useful for built-up/non-built-up area separation. M.G.

N84-30428*# Natural Environment Research Council, Swindon (England).

THE USE OF THEMATIC MAPPER DATA FOR LAND COVER DISCRIMINATION: PRELIMINARY RESULTS FROM THE UK SATMAP PROGRAMME

M. J. JACKSON, J. R. BAKER, J. R. G. TOWNSHEND, J. E. GAYLER, and J. R. HARDY *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 149-152 Jul. 1984 Prepared in cooperation with Reading Univ., England ERTS
 Avail: NTIS HC A09/MF A01 CSCL 08B

In assessing the accuracy of classification techniques for Thematic Mapper data the consistency of the detector-to-detector response is critical. Preliminary studies were undertaken, therefore, to assess the significance of this factor for the TM. The overall structure of the band relationships can be examined by principal component analysis. In order to examine the utility of the Thematic Mapper data more carefully, six different land cover classes approximately Anderson level 1 were selected. These included an area of water from the sediment-laden Mississippi, woodland, agricultural land and urban land. A plume class was also selected which includes the plume of smoke emanating from the power station and drifting over the Mississippi river. M.G.

N84-30429*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT-4 THEMATIC MAPPER SCENE CHARACTERISTICS FOR A SUBURBAN AND REGIONAL TEST SITE

D. L. TOLL *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 153-159 Jul. 1984 refs ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

The primary objective of this effort is to study the LANDSAT Thematic Mapper land use/land cover discrimination performance from a spatial resolution, spectral region and radiometric perspective. Selected methods to improve the land use/land cover performance are also evaluated. Author

N84-30432*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIVE ACCURACY ASSESSMENT OF LANDSAT-4 MSS AND TM DATA FOR LEVEL 1 LAND COVER INVENTORY

E. M. MIDDLETON, R. G. WITT, Y. C. LU (Computer Sciences Corp., Silver Spring, Md.), and R. S. SEKHON (Computer Sciences Corp., Silver Spring, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 171-172 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Digital data for the Washington, D.C. scene from the LANDSAT-4 Multispectral Scanner (MSS) and the LANDSAT-4 Thematic Mapper (TM) are compared. Classification success for the TM and MSS data sets was determined by a per pixel comparison with digitized ground verification data (GVD). These GVD were comprised of Level I land cover (developed, agriculture, forest, water, wetlands, and barren) for four USGS 7.5-minute topographic quadrangle maps. Classification accuracy was computed as an average value and for each cover type. Accuracy was expressed two ways: (1) as the percent correspondence with GVD (% correct) and (2) as the percent correspondence relative to both the GVD and LANDSAT classification schemes. Errors of omission and commission associated with the LANDSAT classifications were also computed. Specific results are discussed. M.G.

N84-30435*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GLOBAL BIOGEOCHEMISTRY: AN OVERVIEW

B. MOORE, III *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A5-A7 Aug. 1984
 Avail: NTIS HC A04/MF A01 CSCL 08B

The dynamic biogeochemical equilibria among the major pools of carbon, nitrogen, sulfur, and phosphorus represented by terrestrial biomes, the world's oceans, and the troposphere are disturbed. Since even the most rapid processes of adjustments among the reservoirs take decades, new equilibria are far from established. These human-induced perturbations and the system's subsequent responses constitute an on-going biogeochemical experiment at the global level. Current and new information must be combined in a way that allows testing of various hypotheses about the workings of global biogeochemical systems. This enables assessment of current knowledge and evaluation of the gaps. B.G.

N84-30566*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STRATOSPHERIC NO AND NO2 PROFILES AT SUNSET FROM ANALYSIS OF HIGH-RESOLUTION BALLOON-BORNE INFRARED SOLAR ABSORPTION SPECTRA OBTAINED AT 33 DEG N AND CALCULATIONS WITH A TIME-DEPENDENT PHOTOCHEMICAL MODEL

C. P. RINSLAND, R. E. BOUGHNER, J. C. LARSEN (Systems and Applied Sciences Corp.), A. GOLDMAN (Denver Univ.), F. J. MURCRAY (Denver Univ.), and D. G. MURCRAY (Denver Univ.)
 Aug. 1984 46 p refs

(NASA-TM-86285; NAS 1.15:86285) Avail: NTIS HC A03/MF A01 CSCL 04A

Simultaneous stratospheric vertical profiles of NO and NO2 at sunset were derived from an analysis of infrared solar absorption spectra recorded from a float altitude of 33 km with an interferometer system during a balloon flight. A nonlinear least squares procedure was used to analyze the spectral data in regions of absorption by NO and NO2 lines. Normalized factors, determined from calculations of time dependent altitude profiles with a detailed photochemical model, were included in the onion peeling analysis to correct for the rapid diurnal changes in NO and NO2 concentrations with time near sunset. The CO2 profile was also derived from the analysis and is reported. R.S.F.

N84-31741*# California Univ., Santa Barbara. Remote Sensing Research Unit.

NASA PILOT LAND DATA SYSTEM

J. E. ESTES, J. L. STAR, Principal Investigators, and J. FRANKLIN *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 6 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

Project development and planning for a Pilot Land Data System (PLDS) are discussed. The PLDS supplies basic information, data management, and data processing capabilities to the land research community. Topics on design and implementation, user requirements, and project management are examined. The scenarios developed thusfar are also included. M.A.C.

N84-31888# National Oceanic and Atmospheric Administration, Rockville, Md. Federal Coordinator for Meteorological Services and Supporting Research.

NATIONAL HURRICANE OPERATIONS PLAN

May 1984 88 p

(PB84-198837; NOAA-84052404; FCM-P12-1984) Avail: NTIS HC A05/MF A01 CSCL 04B

The Hurricane Warning Service is an interdepartmental effort to provide the Nation and designated international recipients with environmental data, forecasts, and assessments concerning tropical and subtropical weather systems. Interdepartmental cooperation achieves economy and efficiency in the operation of the Hurricane Warning Service. This plan provides the basis for implementing the agreements of the Department of Commerce, Department of Defense, and the Department of Transportation,

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reached at the annual Interdepartmental Hurricane Conference (combined Atlantic and Pacific). Author (GRA)

N84-33853# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

MAPPING PROJECT ON LAND USE CHANGES IN THE CARBONIFEROUS REGION OF SANTA CATARINA Preliminary Report [PROJETO MAPEAMENTO DA ALTERACAO DO USO DO SOLO DA REGIAO CARBONIFERA DE SANTA CATARINE - RELATORIO PRELIMINAR]

D. D. VALERIANO and M. D. B. PEREIRA Sep. 1983 14 p refs Sponsored in part by CNPq-INPE/FUNCATE and Secretaria do Meio Ambiente (SEMA) (NASA-CR-173946; NAS 1.26:173946; INPE-2874-NTE/204) Avail: NTIS HC A02/MF A01 CSCL 05B

The utilization of remote sensing data for monitoring land use changes by means of digital image analysis is described. The following data were utilized: LANDSAT data from September 4, 1975, April 24, 1978, and September 8, 1981; LANDSAT paper photography data; area IV color photographs; IBGE topography maps, and auxiliary data about the Brazilian state of Santa Catarina. Three kinds of analyses of digital images were carried out. The project identified and mapped major classes of land use areas including urban areas, coal deposits, agricultural areas, forests, lakes, and flood plains. Five areas directly affected by coal exploration southeast of Santa Catarina are identified and described. In addition, the classification system used for organizing data about land cover in a hierarchical arrangement is presented. The project made use of two remote sensing data sources: data of MSS spectral (Multispectral Scanner System)/LANDSAT on a scale of 1:100,000 with approximately 80 m resolution, and infrared color aerial photographs on a scale of 1:45,000 with approximately 5 m resolution. Therefore, the classification system included three levels, two selected to be compatible with aerial photography data and the third to conform to the resolution of MSS/LANDSAT.

Transl. by B.G.

N84-33885# Consiglio Nazionale delle Ricerche, Milan (Italy). Remote Sensing Dept.

FAST AUTOMATIC RECONNAISSANCE IN LAND OBSERVATIONS IMAGES BY MEANS OF ANALOG AND/OR DIGITAL IMAGES

G. M. LECHI, P. SIMONELLI, R. RIMOLDI, and D. VANETTI In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 177-182 Aug. 1984 refs Avail: NTIS HC A24/MF A01

A methodology for the comparison of multitemporal environmental surveys and to quantify environmental changes occurring over a period of time, in particular the urban growing of a village and of a middle size town were examined. A preprocessing of two aerial surveys of the village was developed to obtain the same average scale and the images were digitized. The on ground spot size provided square pixels of 75 x 75 cm. The images were classified, giving a result containing only the urban build up. From the direct comparison of the two classified matrixes, a matrix of the differences was obtained, containing only the buildings erected in the period considered. Algorithms to reduce the noise of the images, and to optimize the classification were derived. Software created for the analysis of aerial surveys was applied to two LANDSAT MSS images taken over town, and urban growing was measured.

Author (ESA)

N84-33886# Zurich Univ. (Switzerland). Dept. of Geography.

MULTITEMPORAL LANDSAT URBAN AREA CLASSIFICATION M. F. BAUMGARTNER and K. I. ITTEN In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 183-186 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

A 20 channel data set consisting of 5 digitally matched LANDSAT MSS scenes of the metropolitan area of Zurich was classified into 9 preselected cover types concurrent to a reduction of the number of input variables. After testing several reducing methods and classification algorithms, a transformation by the

Fisher linear discriminant analysis together with a maximum likelihood classification shows best results. Author (ESA)

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A84-39877

GEODETIC ASSESSMENT OF KINEMATIC PROCESSES IN THE ALPS

H.-G. KAHLE and ST. MUELLER (Zuerich, Eidgenoessische Technische Hochschule, Zuerich, Switzerland) Annales Geophysicae (ISSN 0755-0685), vol. 2, May-June 1984, p. 229-233. refs

Terrestrial and space-related geodetic surveys have been initiated to assess the kinematics and dynamics of the Alps as part of the NASA Crustal Dynamics Program. Earth-based measurements include levelings, electronic distance measurements, gravity surveys, geodetic-astronomical observations using zenith cameras and tilt measurements with long baseline liquid-tube tiltmeters. The space segment comprises satellite laser ranging (SLR), VLBI and global positioning system data. The target area is along the Alpine-Mediterranean zones of plate boundaries, where the African and Eurasian plates rub against one another. Gravity profile Bourguier plots are presented for three regions of the Alps for which uplift rates and gravity values have been determined.

M.S.K.

A84-39880

SATELLITE LASER RANGING TO MEASURE CRUSTAL MOTION IN THE EASTERN MEDITERRANEAN AREA - INSTRUMENTATION AND NETWORK DESIGN

L. AARDOOM and B. H. W. VAN GELDER (Delft, Technische Hogeschool, Delft, Netherlands) Annales Geophysicae (ISSN 0755-0685), vol. 2, May-June 1984, p. 249-258. refs

Laser ranging to artificial satellites is presented as a technique for precise geodetic point positioning in widely spaced networks. Repeated network determination enables the monitoring of crustal motion. The eastern Mediterranean boundary zone of the Eurasian, African and Arabian tectonic plates was selected as an area of investigation in the framework of NASA's Crustal Dynamics Project. The tectonically complex area is inviting the deployment of newly developed highly transportable laser ranging instrumentation. Such instrumentation is to be acquired by two European geodetic research institutes. Considerations of cost and other constraints call for a balanced network design. An inventory is made as to applicable tectonic plate models. The rigid plate hypothesis is adopted as an initial approximation. A provisional network is subjected to several design criteria. First, the identified plate models are used to assess extension rates between stations. Secondly, the inverse problem of identifying a feasible minimum subset of station-to-station lines enabling the reliable recovery of alleged plate rotations is addressed.

Author

A84-40405* Johns Hopkins Univ., Baltimore, Md.

ON GRAVITY FROM SST, GEOID FROM SEASAT, AND PLATE AGE AND FRACTURE ZONES IN THE PACIFIC

B. D. MARSH (Johns Hopkins University, Baltimore, MD), J. G. MARSH (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, MD), and R. G. WILLIAMSON (EG & G Washington Analytical Services Center, Inc., Riverdale, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, July 10, 1984, p. 6070-6078. refs (Contract NAG5-32)

Data from an additional 50 satellite-to-satellite tracking (SST) passes were combined with earlier measurements of the high degree and order (n, m, 12) gravity in the central Pacific. A composite map was produced which shows good agreement with

conventional GEM models. Data from the Seasat altimeter was reduced and found to agree well with both the SST and the GEM fields. The maps are dominated especially in the east, by a pattern of roughly east-west anomalies with a transverse wavelength of about 2000 km. Further comparison with regional bathymetric data shows a remarkably close correlation with plate age. Each anomaly band is framed by those major fracture zones having large offsets. The regular spacing of these fractures seems to account for the fabric in the gravity fields. Other anomalies are accounted for by hot spots. The source of part of these anomalies is in the lithosphere itself. The possible plume size and ascent velocity necessary to supply deep mantle material to the upper mantle without complete thermal equilibration is considered. Previously announced in STAR as N84-11559 A.R.H.

A84-41973

SATELLITE SYSTEMS FOR CARTOGRAPHY

F. J. DOYLE (U.S. Geological Survey, Reston, VA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 213-222. refs

Mapping from remote sensing records requires image information content and geographic referencing accuracy which are related to the scale of the published map. However, the extraction of cultural planimetric detail requires a ground resolution of about 3m/lp or 1.5 m/pixel regardless of the scale of the final map. The requirements for 1:50,000-scale mapping are not met by Landsat-4 or the SPOT system. The Metric Camera experiment on Spacelab-1 and the Large Format Camera currently planned for Shuttle Missions STS-11 and STS-17 will both provide recovered film data suitable for mapping at 1:50,000 scale. An electrooptical system called MAPSAT has been proposed by the U.S. Geological Survey to meet the same requirements. Author

A84-43429#

TECHNIQUES FOR MEASURING GRAVITY ON AND CLOSE TO THE EARTH'S SURFACE

J. C. HARRISON (Geodynamics Corp., Santa Barbara, CA) IN: Guidance and Control Conference, Seattle, WA, August 20-22, 1984, Technical Papers. New York, American Institute of Aeronautics and Astronautics, 1984, p. 258-263. refs (AIAA PAPER 84-1873)

The historical development of gravimetry is outlined. Currently two types of apparatus are used for measuring gravity on land - gravity meters based on the principle of the spring balance and instruments which measure the acceleration of a freely-falling body directly. Modern instruments of both types are described and their accuracies discussed. Gravity can be measured with reduced accuracy from both surface ships and aircraft. The difficulties inherent in the use of these platforms are outlined and the status of measurements made from them summarized. Author

A84-43788

GEOPOTENTIAL HARMONICS OF ORDERS 15 AND 30

D. G. KING-HELE and D. M. C. WALKER (Royal Aircraft Establishment, Farnborough, Hants., England) Nature (ISSN 0028-0836), vol. 310, July 19, 1984, p. 218, 219. refs

The earth's gravitational potential is usually expressed as a double infinite series of spherical harmonics. In recent models, derived from photographic, radio and laser observations of satellites, gravimetry and satellite altimetry, the harmonics have been evaluated up to a degree and an order of 36 or more, so that there are 1296 or more coefficients to be evaluated. The geoid surfaces derived from such models have errors of approximately 1 m, but much better accuracy is required to take advantage of satellite altimeter measurements accurate to 10 cm or better. So there is a continuing demand to improve the models. The accuracy of the individual coefficients is questionable, and

difficult to estimate. The most precise technique for determining coefficients of a particular order is by analysis of satellite orbits which experience resonance with the earth's gravitational field. Individual harmonic coefficients of orders 15 and 30 have recently been reevaluated from analyses of 24 orbits having a wide range of inclinations to the equator. These coefficients have standard deviations equivalent to an accuracy in geoid height of 1 cm, for degree up to 23, and are valuable as a standard against which the comprehensive gravity field models can be tested. Author

A84-45140

INITIAL RELATIVE POSITIONING RESULTS USING THE GLOBAL POSITIONING SYSTEM

C. C. GOAD and B. W. REMONDI (NOAA, National Geodetic Survey, Rockville, MD) (International Union of Geodesy and Geophysics, General Assembly, 18th, Hamburg, West Germany, Aug. 15-27, 1983) Bulletin Geodesique (ISSN 0007-4632), vol. 58, no. 2, 1984, p. 193-210. refs

Phase data from the GPS satellites obtained using Macrometer model V-1000 single-frequency receivers during March-June, 1983, are analyzed and compared to those of Hothem and Fronczek (1983). The single-difference data-processing technique employed is described, and the numerical comparisons are presented in graphs and tables. Agreement with terrestrial baseline lengths to within about 1 ppm, in azimuthal and vertical angle to within 0.5 arcsec, and in vector closure to within 2.0 ppm is found, and relative ground-clock variations are estimated to within tenths of nanoseconds. The usefulness of the single-frequency receiver for routine surveying over baselines up to 50 km is confirmed. T.K.

N84-29279# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 2: TRANSLATIONS, NUMBER 40

1983 171 p refs

(ISSN-0469-4244) Avail: NTIS HC A08/MF A01

The satellite position program ORBDOP (extended GEODOP); satellite Doppler point positioning using the Navy Navigation Satellite System; Doppler point positioning at timekeeping laboratories in Europe; noise reduction and line following in multiscanned data; imaging quality and heighting accuracy of aerial cameras used at fairly high altitudes; and computer-assisted mapping and charting are discussed.

N84-29286# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 91 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN, REIHE 1: ORIGINALBEITRAEGE, HEFT NR. 91]

1983 100 p refs In GERMAN; ENGLISH and FRENCH summary Original contains large color map (ISSN-0469-4236) Avail: NTIS HC A05/MF A01

A public water supply base map prepared on the basis of the German General Topographic Map 1 : 200,000 is cited. Relationships between ellipsoid parameters, a satellite Doppler positioning network, and design features of an Nd:YAP laser are considered. Automation-assisted revision conception of the General Topographic Map 1 : 200,000 using raster data and a data management system for digital raster maps are included.

N84-29287# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

PUBLIC WATER SUPPLY BASE MAP 1 : 200,000 [DIE ARBEITSKARTE OEFFENTLICHE WASSERVERSORGUNG 1 : 200,000]

R. BOEHME In its Repts. on Cartography and Geodesy. Ser. 1: Original Repts., No. 91 p 5-9 1983 refs In GERMAN; ENGLISH and FRENCH summary Avail: NTIS HC A05/MF A01

A German public water supply base map is presented. It was prepared over a period of 10 years on the basis of the General Topographic Map 1 : 200,000. It comprises 42 sheets.

03 GEODESY AND CARTOGRAPHY

Chronological order of map production, thematic representation and cartographic preparation form the various chapters.

Author (ESA)

N84-29306# Institut fuer Angewandte Geodäsie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 2: TRANSLATIONS, NUMBER 41. REPORT ON HIGH PRECISION GRAVIMETRY, VOLUME 2

E. GROTEN, ed., M. BECKER, H. DRAGERT, E. KANNIESER, A. LAMBERT, J. MAEKINEN, B. RICHTER, and D. WOODWARD 1983 103 p refs Sponsored by International Association of Geodesy

(ISSN-0469-4244) Avail: NTIS HC A06/MF A01

Construction and calibration of a gravimeter; tidal corrections; environmental effects on precise gravity measurements; statistical adjustment and design of high precision measurements; and applications of high precision gravimetry are discussed.

Author (ESA)

N84-29383# Department of the Navy, Washington, D. C. **A METHOD FOR DETERMINING THE MAGNITUDE OF EARTH'S GRAVITY Patent Application**

A. G. EVANS, inventor (to Navy) 27 Feb. 1984 21 p (AD-D011042; US-PATENT-APPL-SN-583562) Avail: NTIS HC A02/MF A01 CSCL 17G

An improved method is described that directly and continuously determines the magnitude of the earth's gravity in relation to a user platform at one or more selected points on or above the Earth's surface. An improved Global Positioning System (GPS) is used to carry out the method and is made up of a plurality of (24) continuously orbiting GPS satellites that are arranged into 3 groups of 8 satellites with each group or constellation being disposed in its respective plane of a series of 3 longitudinal planes. Each plane is arranged in predetermined angular and spatial relation to the Earth's equatorial plane and the other planes of the series. Any GPS satellite continuously transmits a pair of encoded RF signals at predetermined L-band frequencies. By virtue of this global arrangement of the 24 satellites, the antenna field of view of a user platform is capable of receiving at any time the encoded signals of at least six satellites. A geodetic receiver on the platform together with a receiver microprocessor, a navigation microprocessor, and a microcomputer progressively and continuously process signals received from the satellites for the ultimate purpose of comparing GPS determined vertical acceleration (that is normal to the Earth's modeled ellipsoid) with its platform-measured gravimeter acceleration (that is normal to the Earth's geoid) so as to determine, with greater accuracy, the gravity at one or more selected points. GRA

N84-30467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEODYN SYSTEMS DEVELOPMENT

B. H. PUTNEY *In its* Res. Activities of the Geodyn. Branch 4 p Jun. 1984

Avail: NTIS HC A06/MF A01 CSCL 08G

The purpose of the GEODYN Orbit Determination and Parameter Estimation, the SOLVE and ERODYN Programs is to recover geodetic and geophysical parameters from satellite and other data in a state-of-the-art manner. Continued solutions for gravity field, pole positions, Earth rotation, GM, and baselines were made as part of the Crustal Dynamics Project. Some tidal parameters were recovered as well. The eight digit station identification number was incorporated in the software and new techniques for constraining monthly station parameters to each other are being developed. This is allowing the analysts even more flexibility in the shaping of solutions from monthly sets of normal equations and right-hand sides. R.J.F.

N84-30472*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SEASAT ALTIMETRY FOR SURFACE HEIGHT OF INLAND SEAS

J. E. WELKER *In its* Res. Activities of the Geodyn. Branch 6 p Jun. 1984 refs

Avail: NTIS HC A06/MF A01 CSCL 08J

The capability of spaceborne altimetry to record the level, or monitor changes in the level, of inland seas was assessed. SEASAT altimetry data from Lake Baikal in Siberia; the Caspian, Black, and Aral Seas in the southern Soviet Union; the Great Salt Lake in the United States; lakes and reservoirs in northwestern and central China; and snow cover in northwestern India and on the Tibetan Plateau were examined. R.S.F.

N84-30473*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ACCURACY OF MAPPING THE EARTH'S GRAVITY FIELD FINE STRUCTURE WITH A SPACEBORNE GRAVITY GRADIOMETER MISSION

W. D. KAHN *In its* Res. Activities of the Geodyn. Branch 6 p Jun. 1984 refs

Avail: NTIS HC A06/MF A01 CSCL 08B

The spaceborne gravity gradiometer is a potential sensor for mapping the fine structure of the Earth's gravity field. Error analyses were performed to investigate the accuracy of the determination of the Earth's gravity field from a gravity field satellite mission. The orbital height of the spacecraft is the dominating parameter as far as gravity field resolution and accuracies are concerned. R.S.F.

N84-30475*# National Aeronautics and Space Administration, Washington, D. C.

GEODYNAMICS

L. S. WALTER Jul. 1984 61 p Workshop held in Airlie, Va., 15-18 Feb. 1983

(NASA-CP-2325; NAS 1.55:2325) Avail: NTIS HC A04/MF A01 CSCL 08G

The status of space geodynamics is examined, major scientific questions that need to be addressed are identified, and program activities are recommended for the next decade. Progress made in measuring tectonic plates, polar motion, and coupling of fluid motion of the Earth's core to the mantle is reviewed.

N84-30476*# National Aeronautics and Space Administration, Washington, D. C.

GEODYNAMICS: INTRODUCTION AND BACKGROUND

In its Geodyn. p 7-25 Jul. 1984

Avail: NTIS HC A04/MF A01 CSCL 08G

An overview is given of the field of geodynamics and its major scientific questions. The NASA geodynamics program is described as well as its status and accomplishments projected by 1988. Federal coordination and international cooperation in monitoring tectonic plate motion, polar motion, and Earth rotation are mentioned. The development of a GPS receiver for civilian geodesy and results obtained using satellite laser ranging and very long baseline interferometry in measuring crustal dynamics, global dynamics, and the geopotential field are reported. A.R.H.

N84-30477*# National Aeronautics and Space Administration, Washington, D. C.

PROJECTION FOR SPACE GEODYNAMICS, 1988-1998

In its Geodyn. p 27-44 Jul. 1984

Avail: NTIS HC A04/MF A01 CSCL 08G

Premises defining the technical and operational environment of the next decade are listed. Observational programs required to satisfy scientific objectives in the study of geopotential fields, global dynamics, tectonics, and regional tectonics/crustal hazards are defined. Capabilities and applications of the Geopotential Research Mission to be launched in the early 1990's are explored and the benefits of more detailed measurements of the Moon and planets are indicated. Earthquake prediction in the western part of the U.S. is discussed. The use of decimeter, centimeter, and millimeter

systems for very long baseline interferometry, satellite laser ranging, and lunar ranging techniques are discussed. Geographic regions of particular interest are identified. A.R.H.

N84-30478*# National Aeronautics and Space Administration, Washington, D. C.

RECOMMENDED PROGRAM ACTIVITIES, 1988-1998

In its Geodyn. p 45-49 Jul. 1984

Avail: NTIS HC A04/MF A01 CSCL 08G

The observations needed from the standpoint of measurement programs are considered and the technologies which must be developed and the flight missions which must be carried out to support ground-based measurements are discussed. Instrument development for millimeter accuracy in both the horizontal and vertical components as well as for sensitivity to short wavelengths is discussed. Algorithms and models in the application of space data in geodynamics demand special attention. Continued development of airborne and spaceborne laser ranging systems should be supported. A.R.H.

N84-30495# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 92 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE, HEFT NO. 92]

1983 191 p refs Partly in GERMAN and ENGLISH Original contains color illustrations

(ISSN-0469-4236) Avail: NTIS HC A09/MF A01

Mine survey, computer aided mapping, cartographic customer service, and a combined edge program are considered. Forestry conjunction of aerial photography and maps, synthesized color printing, automatic digitization of cartographic linedrawings are included. Regional planning instruments, data interconnection between the automated cadastral plan and topographic cartography, and a cartographic pattern recognition system are described.

N84-31736*# Woods Hole Oceanographic Institution, Mass.

MAGSAT CORRELATIONS WITH GEOID ANOMALIES Final Report

C. O. BOWIN, Principal Investigator 1984 15 p refs ERTS (Contract NAG5-321)

(E84-10174; NASA-CR-173853; NAS 1.26:173853) Avail: NTIS HC A02/MF A01 CSCL 05B

The MAGSAT data of the Gulf of Mexico were analyzed to define better the possible relation of the negative MAGSAT anomaly there to the negative residual geoid anomaly in the western Gulf of Mexico. The estimated magnetic crystal anomaly pattern has a magnetic low in the region of the residual geoid low, but the shape of the anomalies are different. Since the shape and location of the negative magnetic anomaly are variable depending upon the particular polynomial and curve orders used, the degree of correspondence between the residual geoid and MAGSAT lithosphere anomalies was not established definitively. R.S.F.

N84-31766# Defense Nuclear Agency, Washington, D.C.

GEODESY FOR THE LAYMAN Final Report

Dec. 1983 104 p Original contains color illustrations

(AD-A142764; DNA-TR-80-003) Avail: NTIS HC A06/MF A01 CSCL 08E

The basic principles of geodesy are presented in an elementary form. The formation of geodetic datums is introduced and the necessity of connecting or joining datums is discussed. Methods used to connect independent geodetic systems to a single world reference system are discussed, including the role of gravity data. The 1983 edition of this publication contains an expanded discussion of satellite and related technological applications to geodesy and updated description of the World Geodetic System. The basic principles are presented through discussions of various geodetic topics such as: ellipsoids, geoid, horizontal surveying, leveling, geodetic datums and gravity. Author (GRA)

N84-32894*# Woods Hole Oceanographic Institution, Mass.

MAGSAT CORRELATIONS WITH GEOID ANOMALIES Final Report, 15 May 1983 - 15 May 1984

C. O. BOWIN, Principal Investigator 15 May 1984 16 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAG5-321)

(E84-10190; NASA-CR-173676; NAS 1.26:173676) Avail: NTIS HC A02/MF A01 CSCL 08G

A digital data library of MAGSAT data is described and its applications and capabilities are reviewed. Polynomial trends were removed from each half-orbit in order to estimate and remove ring current effects from the data. The MAGSAT data in the Gulf of Mexico region was analyzed to define better the possible relation of the negative MAGSAT anomaly there to the negative residual geoid anomaly in the western Gulf of Mexico. Since the shape and location of the negative magnetic anomaly are variable depending upon the particular polynomial surface and curve orders used, no definitive conclusion as to the degree of correspondence between the residual geoid and MAGSAT lithosphere anomalies is offered. R.S.F.

N84-34736# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).

ACCURACY REQUIREMENTS OF SPACE LASER SYSTEMS FOR GEODETIC APPLICATIONS

R. J. CUNO *In* ESA Space Laser Appl. and Technol. (SPLAT) 8 p May 1984 refs

Avail: NTIS HC A14/MF A01

Two applications of space laser systems for geodetic tasks, and their accuracy requirements are discussed. In one case a satellite borne laser ranging system estimates baseline lengths between passive ground based retroreflectors. In the second case a high stability spaceborne laser forms an optical interferometer together with two retroreflector subsatellites. In this satellite-to-satellite tracking experiment high resolution gravity field information is obtained from the measured relative velocity between the subsatellites. Author (ESA)

N84-34742# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.

SPACE/AIRBORNE LASER RANGING (SALR) AS COMPLEMENT TO GROUND BASED TRANSPORTABLE SATELLITE LASER RANGING (SLR)

B. H. W. VANGELDER and L. AARDOOM *In* ESA Space Laser Appl. and Technol. (SPLAT) 4 p May 1984 refs

Avail: NTIS HC A14/MF A01

The application of space/airborne laser ranging (SALR) techniques to crustal deformation studies is discussed. The deployment of (modular) transportable laser ranging systems ((M)TLRS) is expected to make major contributions to knowledge of the dynamic behavior of the Earth. For reasons of cost effectiveness, the spacing of sites of regional crustal monitoring networks is 500 km and up when visited by (M)TLRS's. The SALR systems are highly cost effective for local surveys with centimeter accuracy, rendering them complementary to groundbased SLR by modular systems. Feasibility studies show that SALR networks must be viewed as a densification of the higher order SLR networks. The SLR sites provide a framework to which the SALR network hindered by problems of critical configuration needs to be tied. The (M)TLRS system can provide observations to facilitate orbit determination of the SALR space segment. Author (ESA)

N84-34809*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ANDEAN TECTONICS: IMPLICATIONS FOR SATELLITE GEODESY

R. J. ALLENBY Sep. 1984 43 p refs

(NASA-TM-86160; NAS 1.15:86160) Avail: NTIS HC A03/MF A01 CSCL 08G

Current knowledge and theories of large scale Andean tectonics as they relate to site planning for the NASA Crustal Dynamics Program's proposed high precision geodetic measurements of

relative motions between the Nazca and South American plates are summarized. The Nazca Plate and its eastern margin, the Peru-Chile Trench, is considered a prototype plate marked by rapid motion, strong seismicity and well defined boundaries. Tectonic activity across the Andes results from the Nazca Plate subducting under the South American plate in a series of discrete platelets with different widths and dip angles. This in turn, is reflected in the tectonic complexity of the Andes which are a multitude of orogenic belts superimposed on each other since the Precambrian. Sites for Crustal Dynamics Program measurements are being located to investigate both interplate and extraplate motions. Observing operations have already been initiated at Arequipa, Peru and Easter Island, Santiago and Cerro Tololo, Chile. Sites under consideration include Iquique, Chile; Oruro and Santa Cruz, Bolivia; Cuzco, Lima, Huancayo and Bayovar, Peru; and Quito and the Galapagos Islands, Ecuador. Based on scientific considerations, Santa Cruz, Huancayo (or Lima), Quito and the Galapagos Islands should be replaced by Isla San Felix, Chile; Brazilia or Petrolina, Brazil; and Guayaquil, Ecuador. If resources permit, additional important sites would be Buenaventura and Villavicencio or Puerto La Concordia, Colombia; and Mendoza and Cordoba, Argentina.

Author

04

GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

A84-39876* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CRUSTAL DYNAMICS PROJECT - STATUS AND PLANS

R. J. COATES (NASA, Goddard Space Flight Center, Greenbelt, MD) *Annales Geophysicae* (ISSN 0755-0685), vol. 2, May-June 1984, p. 225, 226.

The progress of the NASA Crustal Dynamics Project is summarized. The Project is performed to measure regional deformation and strain accumulation due to large earthquakes in the plate boundary region of western N. America, to measure relative plate motions around the globe, to measure internal deformations of continental and oceanic lithospheric plates, to relate the rotational dynamics of the earth to earthquakes, plate motions and other geophysical phenomena and to measure regional fault motions and strain accumulation globally. VLBI and satellite laser ranging (SLR) have been employed using several base and mobile stations in N. America, Europe, S. America and the S. Pacific. Satellite data are being gathered with the LAGEOS spacecraft. Measurement campaigns in S. America and the Caribbean and Mediterranean regions will be carried out with new instrumentation in 1985.

M.S.K.

A84-40162#

APPLICATION OF LANDSAT DATA TO GEOLOGIC MAPPING TROPICAL JUNGLE ENVIRONMENT - CARONI RIVER BASIN, VENEZUELA

H. BRICENO (Colorado School of Mines, Golden, CO; Universidad Central de Venezuela, Caracas, Venezuela) and K. LEE (Colorado School of Mines, Golden, CO) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 123-133. refs

A84-40163*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

GEOBOTANICAL DISCRIMINATION OF ULTRAMAFIC PARENT MATERIALS AN EVALUATION OF REMOTE SENSING TECHNIQUES

D. A. MOUAT (NASA, Ames Research Center, Moffett Field, CA), L. A. MORRISSEY, and E. M. HORN (Technicolor Government Services, Inc., Moffett Field, CA) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 135-144. refs

Color and color infrared aerial photography and imagery acquired from a Daedalus DEI-1260 multispectral airborne scanner were employed in an investigation to discriminate ultramafic rock types in a test site in southwest Oregon. An analysis of the relationships between vegetation characteristics and parent materials was performed using a vegetation classification and map developed for the project, lithologic information derived from published geologic maps of the region, and terrain information gathered in the field. Several analytical methods, including visual image analysis, band ratioing, principal components analysis, and contrast enhancement and subsequent color composite generation were used in the investigation. There was a close correspondence between vegetation types and major rock types. These were readily discriminated by the remote sensing techniques. It was found that ultramafic rock types were separable from non-ultramafic rock types and serpentine was distinguishable from non-serpentinized peridotite. Further investigations involving spectroradiometric and digital classification techniques are being performed to further identify rock types and to discriminate chromium and nickel-bearing rock types.

Author

A84-40164#

IMPACT OF HYDROTHERMALLY ALTERED SOIL ON VEGETATION AS A TOOL IN GEOTHERMAL EXPLORATION

S. CAMACHO, L. DEL RIO, L. SANCHES (Universidad Nacional Autonoma de Mexico, Mexico City, Mexico), and J. GONZALES (IBM de Mexico, Centro Cientifico, Mexico City, Mexico) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 145-153. refs

The spectral reflectance of vegetation over the Caldera of Los Hornos is used to locate potential geothermal areas. The ratio of Landsat band 7 to band 5 is found to be an excellent discriminant between anomalous and background trees. A maximum likelihood classification outlines the anomalous vegetation. This is coupled with a criterion to account for bare spot, mud ponds, fumaroles and other surface manifestations. The result is an outline of the area with highest level of geothermal activity.

Author

A84-40165#

INTEGRATED REMOTE SENSING, GEOLOGICAL AND GEOPHYSICAL DATA PROCESSING AND ANALYSIS FOR HYDROCARBON PROSPECTION IN THE PARANA BASIN, BRAZIL

G. AMARAL (Sao Paulo, Universidade, Sao Paulo, Brazil), P. PAIVA FILHO, and A. P. CROSTA (Themag Engenharia Ltda., Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 155-163. refs

The extensive basaltic lava flows of the Serra Geral Formation (Lower Cretaceous), in the upper portions of the Parana sedimentary basin, are a severe obstacle for hydrocarbon prospection. Its thickness and physical characteristics makes difficult the general application of conventional geophysical methods. In order to overcome this problem a research program was developed for Petrobras in order to obtain the maximum geological information from remote sensing data and integrate it

with field and geophysical data. Automatic analysis of Landsat data with visual inspection of Landsat and SLAR imagery resulted in a large amount of lithological and structural information, which were integrated with geological and geophysical data for the selection of target areas for future investigation. Author

A84-40176#

LANDSAT AND RADAR MAPPING OF INTRUSIVE ROCKS IN SE-BRAZIL

A. R. DOS SANTOS, C. E. DOS ANJOS, J. C. MOREIRA, M. P. BARBOSA, and P. VENEZIANI (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 297-306. refs

The feasibility of intrusive rock mapping was investigated and criteria for regional geological mapping established at the scale of 1:500,000 in polycyclic and polymetamorphic areas using the logic method of photointerpretation of Landsat imagery and radar from the RADAMBRASIL project. The spectral behavior of intrusive rocks, was evaluated using the interactive multispectral image analysis system (Image-100). The region of Campos (city) in northern Rio de Janeiro State was selected as the study area and digital imagery processing and pattern recognition techniques were applied. Various maps at the 2:250,000 scale were obtained to evaluate the results of automatic data processing. Previously announced in STAR as N83-14582 Author

A84-40196#

AUTOMATIC INTERPRETATION OF MSS-LANDSAT DATA APPLIED TO COAL REFUSE SITE STUDIES IN SOUTHERN SANTA CATARINA STATE, BRAZIL

H. J. H. KUX and D. DE M. VALERIANO (Instituto de Pesquisas Espaciais Sao Jose dos Campos, Sao Paulo, Brazil) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 563-572. refs

A84-40203#

APPLICATION OF REMOTE SENSING TECHNIQUES IN GEOLOGICAL MAPPING - A CASE STUDY OF A PRECAMBRIAN TERRAIN

G. SRINIVAS and C. NAGANNA (Bangalore University, Bangalore, India) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 637-648. Research supported by the Indian Space Research Organisation. refs

The present investigation is concerned with the use of Multispectral Scanner System (MSS) data in geological mapping applications. Data are considered regarding a Precambrian terrain in south India, which is locally known as the Chitradurga schist belt. The data were obtained as a result of ground, aerial MSS, and satellite MSS surveys. The aerial MSS data were examined and correlated with the corresponding area on the map. The Landsat enlargement to a scale of 1:250,000 was used for lithological and structural interpretation of the schist belt. Two image enhancement techniques were employed with the objective to increase the amount of information obtainable from the MSS data. A brief description of the geology of the considered area is presented, and the correlation of aerial MSS data with field data from the test area is discussed. Studies based on Landsat imagery are considered, taking into account the geology of the schist belt and its structure. G.R.

A84-40220#

LOCALIZATION OF NEOTECTONIC ACTIVITY WITH THE LANDSAT IMAGES IN LA LAJA (SAN JUAN, ARGENTINA)

S. LENDARO DE GIANNI (Centro Regional de Agua Subterranea, Argentina) and E. ULIARTE (San Juan, Universidad Nacional, San Juan; San Luis, Universidad Nacional, San Luis, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 847-851. refs

The use of Landsat images and aerial photography to locate areas of neotectonic activity in the vicinity of La Laja in central western Argentina is described. The Landsat channel 4, 5, 6, and 7 black-and-white images and 1:500,000 and 1:250,000 false-color images are examined; the areas of contact between Prequaternary rock and Quaternary nonconsolidated sediments are marked on acetate overlays; 1:30,000 aerial photographs are compared; and the alignments identified are checked by aerial observation and field studies. The results are presented in a map and discussed. The image-based alignments are confirmed in more than 90 percent of the cases, indicating the usefulness of this cost-saving technique. T.K.

A84-40226#

MULTITEMPORAL AND GEOBOTANICAL APPROACH IN THE REMOTE DETECTION OF GREISENIZATION AREAS IN THE SERRA DA PEDRA BRANCA GRANITE, GOIAS STATE, BRAZIL

R. ALMEIDA FILHO (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 915-922. refs

A multiseasonal analysis of Landsat multispectral images in CCT format permitted the mapping of lithologic facies in the Pedra Branca Granite, using geobotanical associations, which occur in the form of variations in the density of the cerrado vegetation, as well as the predominance of certain distinct vegetation species. Dry season images did not show very good results in lithological differentiation due to anomalous illumination conditions related to the low solar elevation and the homogeneity in the vegetation cover, specially the grass that becomes dry during this season. Rainy season images, on the other hand, allowed the separation of the lithological types, a fact that can be attributed to a greater differentiation among the geobotanical associations. The muscovite-granite facies with greisenization zones within the Serra da Pedra Branca were mapped. This methodology can be successfully applied to similar known granite bodies elsewhere in the Tin Province of Goias. Previously announced in STAR as N83-14580 Author

A84-40234#

THE APPLICATION OF REMOTE SENSING TECHNIQUE TO THE SURVEY OF GEOLOGICAL STRUCTURES IN LUSHAN GEOTHERMAL AREA, TAIWAN, R.O.C.

W.-J. YUAN and W.-T. CHENG IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 997-1004. Research sponsored by the Ministry of Economic Affairs of Republic of China. refs

A84-40549

MULTISPECTRAL SURVEY OF AN AREA OF SCATTERED DRIFT DEPOSITS BETWEEN WARWICK AND REDDITCH

R. J. O. HAMBLIN and R. G. CROFTS (Natural Environment Research Institute of Geological Sciences, Nottingham, England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 729-732.

Multispectral scanning was evaluated as an aid to the rapid assessment of sand and gravel resources in areas of scattered drift deposits. In the area chosen, where glacial sands and gravels, tills, river terrace deposits and alluvium overlie Mercia Mudstone Group mudstones with thin sandstone bands, it was found possible to delineate areas of alluvium and outcrops of sandstone, but not to distinguish sands and gravels from till clays or from mudstones. The reasons for these results are discussed. Author

A84-43205

THE USE OF SPACE REMOTE SENSING DATA FOR OIL AND GAS EXPLORATION (ON THE EXAMPLE OF SOUTHERN MANGYSHLAK) [ISPOL'ZOVANIE KOSMICHESKOI INFORMATSII PRI NEFTEGAZOPOISKOVYKH RABOTAKH /NA PRIMERE IUZHNOGO MANGYSHLAKA/]

V. T. VOROB'EV and D. S. ORUDZHEVA (Akademiia Nauk SSSR, Institut Geologii i Razrabotki Goriuchikh Iskopaemykh, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 33-38. In Russian. refs

An analysis of geological-geophysical data and the interpretation of space photographs make it possible to demonstrate the connection between oil and gas deposits in southern Mangyshlak, Kazakhstan and certain fault zones. These are zones of regional neotectonic faults, zones of recent extensions in regions of recent positive vertical movements, areas of local neotectonic uplift, and areas of moderate lineament density. B.J.

A84-43207

RELATIVE GEOLOGICAL INFORMATION CONTENT OF SMALL-SCALE MULTISPECTRAL SPACE IMAGES (ON THE EXAMPLE OF THE FERGANA DEPRESSION AND THE ADJACENT MOUNTAINS) [OTNOSITEL'NAIA GEOLOGICHESKAIA INFORMATIVNOST' MELKOMASSHTABNYKH MNOGOZONAL'NYKH KOSMICHESKIKH IZOBRAZHENII /NA PRIMERE FERGANSKOI VPADINY I EE GORNOGO OBRAMLENIIA/]

B. G. AZIMOV (Akademiia Nauk SSSR, Geologicheskii Institut, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 44-49. In Russian. refs

A84-43215

AUTOMATED PROCESSING OF DATA OF INTERPRETATION AND IDENTIFICATION OF LINEAMENTS ON SPACE IMAGES [OPYT AVTOMATIZATSII OBRABOTKI DANNYKH DESHIFIROVANIIA I VYDELENIIA LINEINYKH ELEMENTOV PO KOSMICHESKIM SNIMKAM]

V. I. A. GOLTVEGER, V. A. ILIN, and N. M. KUNINA (Proizvodstvennoe Geologicheskoe Ob'edinenie Aerogeologiya, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 97-105. In Russian. refs

The paper presents results of the computer-aided identification of geological lineaments on satellite remote-sensing images, and compares these results with visual-interpretation data. Digital processing methods were used to automate labor-consuming processes: i.e., to compile maps of lineament density, to identify lineaments of different orientations, and to construct rose-diagrams. B.J.

A84-44137* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEOLOGIC MAPPING USING THERMAL IMAGES

M. J. ABRAMS, A. B. KAHLE, F. D. PALLUCONI, and J. P. SCHIELDGE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 13-33. NASA-supported research. refs

Thermal radiance data from the Heat Capacity Mapping Mission (HCMM) satellite has been used to measure surface reflectance data and to provide additional material composition information through remote sensing. The primary goal was to investigate the utility of HCMM data for geologic applications. Three techniques were used for displaying and combining thermal and visible near infrared (VNIR) data for two desert areas in southern California (Trona and Piasgah): color additive composites (CAC) for day and night IR and day VNIR, principal components, and calculation of thermal inertia images. The HCMM thermal data were more effective than Landsat data in producing separation of compositionally different areas including volcanic and intrusive rocks. The satellite CAC data produced an image for a 1 x 2 degree area, and the color picture was enlarged to a scale of 1:250,000. Playa composition, moisture content, presence of standing water, and vegetation cover were displayed in a variety of colors according to physical characteristics. Areas such as sand dunes were not distinguishable because of the coarse 500-mm HCMM resolution. HCMM thermal data have shown a new dimension to geologic remote sensing, and future satellite missions should allow the continued development of the thermal infrared data for geology. J.P.

A84-44924* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

LANDSAT-4 THEMATIC MAPPER AND THEMATIC MAPPER SIMULATOR DATA FOR A PORPHYRY COPPER DEPOSIT

M. J. ABRAMS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Aug. 1984, p. 1171-1173. NASA-supported research.

Aircraft thematic mapper (TM) data were analyzed to evaluate the potential utility of the Landsat-4 thematic mapper for geologic mapping and detection of hydrothermal alteration zones in the Silver Bell porphyry copper deposit in southern Arizona. The data allow a comparison between aircraft TV simulator data and the Landsat-4 TM satellite data which possess similar spectral bands. A color rationcomposite of 30-m pixels was resampled, in order to clearly define a number of hydroxyl bearing minerals, (kaolinite, sericite, white mica), pyrite and iron oxide/hydroxide minerals. The iron oxide minerals have diagnostic absorption bands in the 0.45 and 0.85 micron regions of the spectrum, and the hydrous minerals are characterized by an absorption in the 2.2 micron region. The position of the spectral bands allow the TM to identify regions of hydrothermal alteration without resorting to a data processing algorithm. The comparison of the aircraft and Landsat-4 TM data showed considerable agreement, and confirmed the utility of TM data for identifying hydrothermal alteration zones. Samples of some color TM images are provided. I.H.

A84-45916* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DETECTION OF SUBSURFACE FEATURES IN SEASAT RADAR IMAGES OF MEANS VALLEY, MOJAVE DESERT, CALIFORNIA

R. G. BLOM (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, California, University, Santa Barbara, CA), R. E. CRIPPEN (California, University, Santa Barbara, CA), and C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Geology (ISSN 0091-7613), vol. 12, June 1984, p. 346-349. Research supported by the University of California. refs (Contract NAG5-177)

Igneous dikes buried beneath as much as 2 m of alluvium in the Mojave Desert of California were detected by the Seasat L-band (23.5-cm wavelength) synthetic-aperture radar (SAR) in 1978. The

roughness and dihedral configuration of the dikes are favorable to generation of strong radar echos. The soil-moisture levels in 1978 were likely below the critical 1 percent level. The other permissive conditions for radar penetration of a fine-grained and thin alluvial cover are present. Our findings suggest that subsurface features with potential tectonic or geomorphic significance may be revealed in other orbital radar images of semiarid terrains.

Author

A84-46688

THE TECTONIC AND VOLCANIC HISTORY OF DIONE

J. M. MOORE (Arizona State University, Tempe, AZ) (Natural Satellites Conference, Ithaca, NY, July 5-9, 1983) *Icarus* (ISSN 0019-1035), vol. 59, Aug. 1984, p. 205-220. Research supported by the Arizona State University and University of Oklahoma. refs

The tectonic and volcanic modifications of Dione are described and interpreted. It is proposed that after the formation of a brittle outer shell, but before the end of heavy meteoritic bombardment, global expansion due to radionuclide heating (and perhaps a loss of oblateness due to tidal despinning and orbital recession) produced a global system of lineaments. An NH₃ (H₂O) melt was produced and 'erupted' on the surface to form plains units. Cooling of the interior (or a phase change) led to horizontal compression in the surface. Compression of a thick deposit of plains material, possibly overlying a decollement surface, is proposed to explain cratered-plains ridges developed as thrust or high-angle reverse faults. Following formation of ridges and smooth plains, the surface experienced light cratering.

Author

A84-48050

AN EXPERIMENT OF COMPLEX THEMATIC MAPPING USING SPACE DATA [OPYT KOMPLEKSNOGO TEMATICHESKOGO KARTOGRAFIROVANIYA S ISPOL'ZOVANIEM KOSMICHESKOI INFORMATSII]

V. A. ASTAKHOVA, V. V. KOZLOV, and V. I. RIABCHIKOVA (Geodeziya i Kartografiya (ISSN 0016-7126), July 1984, p. 40-44. In Russian.

A spaceborne thematic mapping technique has been applied to the exploration of sub-Arctic regions of the northeastern USSR. This paper presents a block diagram for the interpretation of profiling elements of thematic content; the diagram represents the compilation of combined thematic maps (geological, geomorphological, and landscape) on the example of the interpretation of crustal faults. Fragments of schemes of geomorphological and landscape interpretation are also presented.

B.J.

A84-49031

ENGINEERING EVALUATION OF FAULTS OF THE EARTH CRUST ON THE BASIS OF SPACE IMAGERY [INZHENERNAIA OTSENKA RAZLOMOV ZEMNOI KORY PO DANNYM S'EMKI IZ KOSMOSA]

A. L. REVZON (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Transportnogo Stroitel'stva, Moscow, USSR) *Issledovanie Zemli iz Kosmosa* (ISSN 0205-9614), July-Aug. 1984, p. 53-60. In Russian.

A84-49142#

CONTRIBUTION OF LANDSAT-4 THEMATIC MAPPER DATA TO GEOLOGIC EXPLORATION

J. R. EVERETT, J. D. DYKSTRA, and C. A. SHEFFIELD (Earth Satellite Corp., Chevy Chase, MD) *IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 162-168.*

An assessment is made of the Landsat-4 Thematic Mapper (TM) utility in geological studies. A felicitous coincidence is noted in the simultaneous development of satellite remote sensing and the concepts of plate tectonics and vertical migration of hydrocarbons. Effective, rapid examinations have become possible for large land areas, in search for indications of valuable and exploitable resources. The synoptic view of satellite images and the relatively high resolution of TM data allows researchers to

recognize regional tectonic patterns and map them in substantial detail. The refined spatial and spectral characteristics and digital nature of the TM data allow detection and enhancement of signs of surface alterations associated with hydrothermal activity and microseepage of hydrocarbons.

O.C.

N84-28870# Joint Publications Research Service, Arlington, Va. SENSING OF FACTORS INVOLVED IN DEVELOPMENT OF EXOGENOUS PROCESSES ON SPACE PHOTOGRAPHS OF ARID TERRITORIES Abstract Only

A. I. SVITNEV, M. I. BURLESHIN, and I. D. KOLESNIKOV *In its USSR Rept.: Space (JPRS-USP-84-003) p 103 14 Jun. 1984 Transl. into ENGLISH from Issled. Zemli Kosmosa (USSR), no. 5, Sep.-Oct. 1983 p 40-48 Original language document announced as A84-14844*

Avail: NTIS HC A07

The possibility of using space images of different levels of generalization for the indication of the geological-structural and climatic factors in the development of exogenic processes is examined. By way of example, attention is given to the study of the development of Karst, aeolian, and landslide processes on the basis of space images of a local level of generalization for arid platform regions.

R.J.F.

N84-28871# Joint Publications Research Service, Arlington, Va. STRUCTURAL-GEOMORPHOLOGICAL INTERPRETATION OF LINEAMENTS DETECTED FROM SPACE PHOTOGRAPHS AND PATTERNS OF MINERAL DISTRIBUTION Abstract Only

A. Y. FEDOROV and Y. K. YELISTRATOVA *In its USSR Rept.: Space (JPRS-USP-84-003) p 103-104 14 Jun. 1984 Transl. into ENGLISH from Issled. Zemli Kosmosa (USSR), no. 5, Sep.-Oct. 1983 p 49-59*

Avail: NTIS HC A07

Stereoscopic interpretation of space photographs, from the Meteor satellites at scales of 1:10,000,000 and 1:2,500,000 for the Ural region were used in defining first order lineaments grouped into a hexagonal lattice, illustrated in a map of interpreted features. The parameters of the lattice were examined for latitudes 52-58 degrees N; the average distance between the points of intersection of lineaments was 274 km; the average distance between lineaments was 235 km. The mapped lattice was subjected to geological-geomorphological and geophysical analysis for ascertaining its reality and investigating its properties. The specific results of this analysis are presented in detail, taking into account the different plotted features (first order faults of the meridional lattice; second and third order faults of this same lattice; faults in latitudinal hexagonal lattice; main and secondary water-divides, elevations, large and small intrusions and dikes, etc.). The position and strike of these lineaments are examined in relation to the magnetic and gravitational fields. It is confirmed that the lineaments are basement faults forming the present-day relief; the defined hexagonal lattice was found to be real and the first order faults, of considerable extent and width, in essence are zones of increased crustal permeability.

R.J.F.

N84-29268# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

MINERALS

In its Yearbook of the Bureau of Mineral Resources, Geol. and Geophys., Canberra, 1 Jul. 1982 - 30 Jun. 1983 p 42-66 30 Jun. 1983

Avail: NTIS HC A08/MF A01

The Minerals Program of the Australian Bureau of Mineral Resources aims to develop the understanding of the origin, abundance, age, and distribution of Australia's mineral resources in the context of the structure and geological history of the continent as a basis for exploration and assessment. Research from the following subprograms of the Minerals Program was reviewed: (1) the origin and distribution of minerals in space and time, (2) the metallogenic provinces of Australia, (3) remote sensing techniques applied to Australia's weathered zone and its related minerals, (4) airborne geophysical mapping, (5) crustal geophysics, and (6) the origin and distribution of offshore mineral deposits.

R.S.F.

04 GEOLOGY AND MINERAL RESOURCES

N84-29275*# Earth Satellite Corp., Chevy Chase, Md.
EVALUATION OF LANDSAT-D THEMATIC MAPPER PERFORMANCE AS APPLIED TO HYDROCARBON EXPLORATION Final Report

J. D. DYKSTRA, J. R. EVERETT, R. LIVACCARRI, R. MICHAEL, G. RICHARDSON, S. PRUCHA, O. RUSSELL, M. RUTH, C. A. SHEFFIELD, and R. STASKOWSKI Jun. 1984 249 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS5-27384)

(E84-10154; NASA-CR-173666; NAS 1.26:173666; REPT-1459)

Avail: NTIS HC A11/MF A01 CSCL 05B

Work with digital data of Oklahoma, Colorado, Wyoming, Utah and California demonstrate that the increased spectral refinement and spatial resolution of TM over MSS data greatly increase the value of the data to petroleum exploration in roles ranging from logistic planning to direct detection of phenomena related to microseepage of hydrocarbons. The value of the spatial content versus the spectral content of the data increases as soil and vegetation cover increase. The structural detail visible in the imagery can contribute to exploration at the prospect level. Examination of the variance/covariance matrix suggests that a combination of bands 1, 4, and 5 displays the most information for most areas. M.A.C.

N84-29303# Susquehanna Resources and Environment, Inc., Johnson City, N.Y.

APPLICATIONS OF TEXTURE ANALYSIS FOR ROCK TYPES DISCRIMINATION, PHASE 2 Final Report, Nov. 1982 - Nov. 1983

S. HSU Dec. 1983 64 p

(Contract F49620-83-C-0029; ARPA ORDER 4288)

(AD-A142268; AFOSR-84-0477TR) Avail: NTIS HC A04/MF

A01 CSCL 14E

Aimed at developing image processing methods for rock types analysis with LANDSAT data, numerous experiments were conducted using supervised and unsupervised classification techniques under the general concept of texture analysis with LANDSAT digital data covering two geological quads of Nevada. The results indicate that the supervised classification method is very effective in the extraction of granite regions when (1) data were in ratio format, (2) feature variables included both tone and texture information, and (3) the classifier is capable of handling non-normally distributed data. Classification errors occurred when there exists pixels of non-granite category whose spectral and textural properties are statistically similar to that of granite pixels. Two cases of errors can be noted: Type 1 pixels located at the periphery of the granite regions, and Type 2 pixels located far away from the core of the granite areas. GRA

N84-30390*# Geological Survey, Reston, Va.

ANALYSIS OF LANDSAT-4 TM DATA FOR LITHOLOGIC AND IMAGE MAPPING PURPOSE

M. H. PODWYSOCKI, J. W. SALISBURY, L. V. BENDER, O. D. JONES, and D. L. MIMMS In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 35-39 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Lithologic mapping techniques using the near infrared bands of the Thematic Mapper onboard the LANDSAT 4 satellite are investigated. These methods are coupled with digital masking to test the capability of mapping geologic materials. Data are examined under medium to low Sun angle illumination conditions to determine the detection limits of materials with absorption features. Several detection anomalies are observed and explained. M.A.C.

N84-30412*# Earth Satellite Corp., Chevy Chase, Md.

EVALUATION OF LANDSAT-4 THEMATIC MAPPER DATA AS APPLIED TO GEOLOGIC EXPLORATION: SUMMARY OF RESULTS

J. D. DYKSTRA, C. A. SHEFFIELD, and J. R. EVERETT In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 103-108 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01

As with any tool applied to geologic exploration, maximum value results from the innovative integration of optimally processed LANDSAT-4 data with existing pertinent information and perceptive geologic thinking. The synoptic view of the satellite images and the relatively high resolution of the data permits recognition of regional tectonic patterns and their detailed mapping. The refined spatial and spectral characteristics and digital nature surface alterations associated with hydrothermal activity and microseepage of hydrocarbons. In general, as vegetation and soil cover increase, the value of spectral components of TM data decreases with respect to the value of the spatial component of the data. This observation reinforces the experience from working with MSS data that digital processing must be optimized both for the area and for the application. A.R.H.

N84-30413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

PRELIMINARY GEOLOGIC/SPECTRAL ANALYSIS OF LANDSAT-4 THEMATIC MAPPER DATA, WIND RIVER/BIGHORN BASIN AREA, WYOMING Abstract Only

H. R. LANG, J. E. CONEL, and E. D. PAYLOR In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 109-110 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08G

A LIDQA evaluation for geologic applications of a LANDSAT TM scene covering the Wind River/Bighorn Basin area, Wyoming, is examined. This involves a quantitative assessment of data quality including spatial and spectral characteristics. Analysis is concentrated on the 6 visible, near infrared, and short wavelength infrared bands. Preliminary analysis demonstrates that: (1) principal component images derived from the correlation matrix provide the most useful geologic information. To extract surface spectral reflectance, the TM radiance data must be calibrated. Scatterplots demonstrate that TM data can be calibrated and sensor response is essentially linear. Low instrumental offset and gain settings result in spectral data that do not utilize the full dynamic range of the TM system. M.A.C.

N84-30416*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ASSESSMENT OF COMPUTER-BASED GEOLOGIC MAPPING OF ROCK UNITS IN THE LANDSAT-4 SCENE OF NORTHERN DEATH VALLEY, CALIFORNIA

N. M. SHORT In its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 114-115 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

Results from a series of geologic classifications conducted on a thematic mapper subscene of the northern Death Valley, California are reported. Measurements of accuracy are made through comparison with the 1977 edition of the Death Valley geologic sheet. This employs a simplified map version which is registered by computer to the image data base, allowing a pixel by pixel match with the classified scene. The results show accuracy ranges from 36 to 79% depending on the type of classifier used and the statistical adjustments made to the data. Accuracy values in identifying geologic units were 2 to 3 times higher for those in the relatively flat valleys than for units in the rugged mountainous terrain. Improvements in accuracy will be sought by correcting for slope/aspect variations in mountainous terrain using topographic data recorded in Defense Mapping Agency (DMA) tapes. The above classification results will also be compared with ratio and principal

component image classifications made from the same scene.

M.G.

N84-30430*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FINAL COMPARISON OF TM AND MSS DATA FOR SURFACE MINE ASSESSMENT IN LOGAN COUNTY, WEST VIRGINIA

R. G. WITT, H. W. BLODGET, and R. M. MARCELL (Scientific Applications Research, Riverdale, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 160-166 Jul. 1984 refs ERTS

Avail: NTIS HC A09/MF A01 CSCL 08I

A variety of classifications during both raw and transformed MSS and TM data sets from 4 September 1982 were performed for the Logan County, West Virginia study area. The object was to compare the utility of TM and MSS data for delineating small, irregular ground features, particularly surface mines, and also to test data reduction/transformation techniques (band selection, canonical analysis, and principal components) in relation to a traditional means of unsupervised classification. Statistical results demonstrate that, on the average, the TM classifications yielded an overall .53 factor of improvement relative to the MSS classifications. When the accuracies for only three minor (in terms of areal extent) land use categories are examined, the factor of improvement for TM over MSS increases to 1.48; i.e., the TM is nearly one and one-half times better than the MSS for delineating small and irregular ground features such as contour strip mines.

M.G.

N84-30569# Institute of Space and Astronautical Science, Tokyo (Japan).

DERIVATION OF CRUSTAL MAGNETIC ANOMALIES FROM MAGSAT

M. YANAGISAWA Feb. 1984 68 p refs

(REPT-609; ISSN-0285-6808) Avail: NTIS HC A04/MF A01

Various characteristics of the magnetospheric field, induction field, and ionospheric field observed by MAGSAT and the derivation of crustal magnetic anomalies free from disturbance fields are described. After eliminating the effect of the disturbance field, anomaly maps were derived for the Japanese area and Shatsky Rise area. Spherical harmonic expansion of the magnetospheric field, induction field, and ionospheric field shows that the first degree term could well approximate the magnetospheric and induction fields. These fields can easily be excluded by the subtraction of the best fitted first degree spherical harmonic fields. Close resemblance between dawn and dusk side anomalies show that the maps are nearly free from the effects of induction, ionospheric, and magnetospheric fields.

S.B.

N84-31760*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AGE DISCRIMINATION AMONG BASALT FLOWS USING DIGITALLY ENHANCED LANDSAT IMAGERY

H. W. BLODGET and G. F. BROWN (Globex, Inc., Reston, Va.) Aug. 1984 13 p refs Presented at the Am. Soc. of Photogrammetry, San Antonio, 9-14 Sep. 1984 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E84-10189; NASA-TM-86141; NAS 1.15:86141) Avail: NTIS HC A02/MF A01 CSCL 08G

Digitally enhanced LANDSAT MSS data were used to discriminate among basalt flows of historical to Tertiary age, at a test site in Northwestern Saudi Arabia. Spectral signatures compared favorably with a field-defined classification that permits discrimination among five groups of basalt flows on the basis of geomorphic criteria. Characteristics that contributed to age definition include: surface texture, weathering, color, drainage evolution, and khabrah development. The inherent gradation in the evolution of geomorphic parameters, however, makes visual extrapolation between areas subjective. Therefore, incorporation of spectrally-derived volcanic units into the mapping process should produce more quantitatively consistent age groupings. Author

N84-31858# Texas Univ., Austin. Bureau of Geology.

LINEAMENTS OF TEXAS: POSSIBLE SURFACE EXPRESSIONS OF DEEP-SEATED PHENOMENA Final Report

C. M. WOODRUFF, JR. and S. C. CARAN Apr. 1984 100 p refs

(Contract DE-AS07-79ID-12057)

(DE84-010827; DOE/ID-12057/T7) Avail: NTIS HC A05/MF A01

Lineaments were identified on 51 LANDSAT images covering Texas and parts of adjacent states in Mexico and the United States. A method of identifying lineaments was designed so that the findings would be consistent, uncomplicated, objective, and reproducible. Lineaments denoted on the LANDSAT images were traced onto 1:250,000-scale work maps and then rendered cartographically on maps representing each of the 51 LANDSAT images at a scale of 1:500,000. At this stage more than 31,000 lineaments were identified. It included significant areas outside of Texas. In preparing the final lineament map of Texas at 1:1,000,000-scale from the 1:500,000-scale maps, all features that lay outside Texas and repetition among features perceived by individual workers were eliminated. Cultural features were checked for before reducing and cartographically fitting the mosaic of 51 individual map sheets to a single map base. Lineaments that were partly colinear but with different end points were modified into a single lineament trace with the combined length of the two or more colinear lineaments.

DOE

N84-31861# National Geodetic Survey, Rockville, Md.

STATISTICAL TESTS FOR DETECTING CRUSTAL MOVEMENTS USING BAYESIAN INFERENCE

K. R. KOCH 1984 12 p refs

(PB84-198811; NOAA-TR-NOS-NGS-29; NOAA-84060405) Avail: NTIS HC A02/MF A01 CSCL 08K

The test of a general linear hypothesis in sampling theory, applied to the detection of recent crustal movements, is compared with Bayesian inference based on vague prior distributions. Both approaches give equivalent results. In addition, the test of inequality constraints can be readily derived by Bayesian inference. Also, less sensitive and more realistic tests than the ones of the sampling theory of the detection of crustal movements are obtained by Bayesian inference. These tests are simple to apply, as the distribution needed is the central F-distribution. As an example, two epochs of leveling data are analyzed in the Houston-Galveston, Tex., region, an area of marked land subsidence. Author (GRA)

N84-32895*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MAPPING MAGNETIZED GEOLOGIC STRUCTURES FROM SPACE: THE EFFECT OF ORBITAL AND BODY PARAMETERS

C. C. SCHNETZLER, P. T. TAYLOR, and R. A. LANGE Aug. 1984 22 p refs ERTS

(E84-10191; NASA-TM-86134; NAS 1.15:86134) Avail: NTIS HC A02/MF A01 CSCL 08G

When comparing previous satellite magnetometer missions (such as MAGSAT) with proposed new programs (for example, Geopotential Research Mission, GRM) it is important to quantify the difference in scientific information obtained. The ability to resolve separate magnetic blocks (simulating geological units) is used as a parameter for evaluating the expected geologic information from each mission. The effect of satellite orbital altitude on the ability to resolve two magnetic blocks with varying separations is evaluated and quantified. A systematic, nonlinear, relationship exists between resolution and distance between magnetic blocks as a function of orbital altitude. The proposed GRM would provide an order-of-magnitude greater anomaly resolution than the earlier MAGSAT mission for widely separated bodies. The resolution achieved at any particular altitude varies depending on the location of the bodies and orientation. M.A.C.

04 GEOLOGY AND MINERAL RESOURCES

N84-33856# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

A COMPARATIVE STUDY OF DIFFERENT PRODUCTS OF SENSOR SYSTEMS APPLIED IN A LITHOLOGIC-STRUCTURAL ANALYSIS OF THE QUADRILATERO FERRIFERO AREA, MINAS GERAIS M.S. Thesis - 18 Jul. 1983 [ESTUDO COMPARATIVO ENTRE DIFERENTES PRODUTOS DE SISTEMAS SENSOES APLICADOS A ANALISE LITOLOGICO-ESTRUTURAL NO QUADRILATERO FERRIFERO, MINAS GERAIS]

C. RICCOMINI Jul. 1984 115 p refs In PORTUGUESE; ENGLISH summary Original doc. contains color illustrations (INPE-3210-TDL/174) Avail: NTIS HC A06/MF A01

Through the integrated analysis of remote sensing products, such as RBV-LANDSAT and MSS-LANDSAT imagery (channels 5, 6 and 7, in paper prints and computer compatible tapes - CCTs in the MSS case), semicontrolled mosaics of radar airborne imagery (NASA Mission 96 and RADAMBRASIL Project) and aerial Ektachrome MS Aerographic and Ektachrome IR Aerographic photographs (NASA Mission 96), it was developed a comparative study of the performance of these products in the lithologic-structural analysis of the Quadrilatero Ferrifero area (Minas Gerais State, Brazil). The adopted methodology consisted basically on visual interpretation, first of the small scale products (LANDSAT and radar imagery), and afterwards of the middle scale products (LANDSAT MSS enlarged and processed in the Image-100 computer), and finally the large scale products (aerial photographs). The results obtained from photointerpretation were then compared to available geological maps and bibliography which was followed by a field investigation. RBV and MSS-LANDSAT imagery has demonstrated a good performance in geological mapping, with an information degree compatible to their scales of presentation.

Author

N84-33865# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany).

MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS) DATA OF BOLIVIA: COMPARISON WITH LANDSAT MULTISPECTRAL SCANNER (MSS) AND GEOLOGICAL INTERPRETATION

K. HILLER and M. HAUCK (Technische Univ., Munich) In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 45-48 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Data from Modular Optoelectronic Multispectral Scanner (MOMS-01) over the Andes in southern Bolivia, northern Chile and Argentina are used to identify geological features on the surfaces of Salar de Uyuni, Salar Punta Negra and Salar de Arizaro. Giant polygons, shorelines, salt channels and wind plumes are distinguishable. The comparison with corresponding LANDSAT-MSS data in the 600 nm range reveals the advantages of the MOMS 20 m versus LANDSAT versus 80 m resolution with respect to the morphology of salt crusts.

Author (ESA)

N84-33867# Technische Univ., Munich (West Germany). Inst. for General and Applied Geology.

THE PILBARA DISTRICT IN NORTHWESTERN AUSTRALIA: A CASE STUDY FOR THE GEOLOGICAL APPLICATION OF MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS) AND LANDSAT DATA

F. JASKOLLA In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 59-62 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

By use of Modular Optoelectronic Multispectral Scanner and LANDSAT-MSS data, a geological mapping in Northwestern Australia / Pilbara district was carried out. Based on combined imageries of both systems via the IHS-approach, important improvements for geology can be elaborated.

Author (ESA)

N84-33890# Centre National de la Recherche Scientifique, Garchy (France). Centre de Recherches Geophysiques.

EVALUATION OF THE USE OF THERMAL AIRBORNE PROSPECTION FOR ARCHAEOLOGY DURING THE LAST 10 YEARS

A. TABBAGH In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 205-208 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Thermal remote sensing was used to study ancient landscapes and archaeological features in France, using the scanner radiometer ARIES. Temperature differences that appear on soil surface in connection with archeological remains come from microrelief effects and from variations in the soil thermal properties. Study of these properties, calculation of slow transient in flux variation and the building up of theoretical three dimensional models were necessary for interpretation of results and for forecasting the most favorable time for measuring. Successes are obtained in various conditions in detecting local features and determining the ancient general landscape organization. This method is also satisfactory for describing the superficial geological context.

Author (ESA)

N84-33894# IBM France S. A., Paris. Centre Scientifique.

INTERPRETATION OF COMBINED LANDSAT-HEAT CAPACITY MAPPING MISSION (HCMM) DATA FOR GEOLOGICAL ANALYSIS. EVALUATION OF SCALE EFFECT ON INTERPRETATION OF A MULTISOURCE IMAGE [INTERPRETATIONS DES DONNEES HCMM ET LANDSAT COMBINES POUR L'ANALYSE GEOLOGIQUE. EVALUATION D'UN EFFET D'ECHELLE EN INTERPRETATION D'IMAGE MULTI-SOURCES]

Y. RABU, M. ABRAMS, W. NIBLACK, and J. CHOROWICZ (Paris VI Univer.) In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 231-236 Aug. 1984 refs In FRENCH Original contains color illustrations

Avail: NTIS HC A24/MF A01

LANDSAT multispectral scanner images were combined with heat capacity mapping mission (HCMM) night infrared and thermal inertia images to produce a geological map. Quantitative evaluation using Bayesian maximum likelihood estimates shows the benefits of adding the images. Night infrared images are more useful than thermal inertia. All processing manipulations can be done on a small scale, before resampling using a more precise scale. Data with an original geometric resolution of 600 m can be exploited at 80 m. Vegetation is not the dominant factor in the variability of the spectral response.

Author (ESA)

N84-33895# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

COMPARATIVE GEOLOGIC ANALYSIS OF LANDSAT AND SHUTTLE IMAGING RADAR (SIR)-A IMAGES OF THE ADRAR DES IFORAS AREA IN NE MALI

A. SIEBER and B. THEILEN-WILLIGE (Technische Universitaet, Clausthal-Zellerfeld, West Germany) In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 237-239 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Geologic evaluations and mappings based on Shuttle Imaging Radar (SIR-A) images are compared with geologic maps to demonstrate the value of spaceborne radar images for providing additional geologic information. Comparative geologic evaluations of LANDSAT and SIR-A images demonstrate that SIR-A images contain more lithologic and structural information than LANDSAT images. Due to the capability of radar signals to penetrate through thin sedimentary layers into the subsurface, lithologic units and tectonic features become visible on SIR-A images that are unattainable on LANDSAT images and on aerial photographs.

Author (ESA)

N84-33899# Technische Univ., Munich (West Germany). Inst. for General and Applied Geology.

THE APPLICABILITY OF IMPROVED REMOTE SENSING DATA FOR LITHOLOGICAL AND STRUCTURAL MAPPING

F. JASKOLLA and H. KAUFMANN / In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 265-271 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

The use of advanced sensors characterized by improved ground pixel sizes and an increasing number of spectral bands in structural and lithological mapping is discussed. It is demonstrated that NASA's Thematic Mapper is the most sophisticated Earth sensing capability, although the possibilities of stereoscopic data acquisition are very limited. To overcome this insufficiency, the possibilities of improved sensors based on CCD technology must be considered, since they sample multispectral and stereoscopic data simultaneously. Author (ESA)

N84-33900# Consiglio Nazionale delle Ricerche, Frascati (Italy). Ist. Astrofisica Spaziale.

AN INTERACTIVE PROCEDURE FOR THE ANALYSIS OF LINEAR ELEMENTS DETECTED IN LANDSAT PICTURES: AN APPLICATION TO NORTHERN MOZAMBIQUE

T. CIRILLO (Ordine Nazionale dei Geologi, Rome) and M. POSCOLIERI / In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 273-280 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

The lineaments of Northern Mozambique were studied using LANDSAT imagery. A procedure for analysing these features, on the basis of their orientation and length, in both the whole area and 1 deg sq sized subsets of it was developed. Once regional azimuthal trends were identified, numerical parameters, measuring the presence of these domains in each cell were derived. These values, shown by contour maps, reveal the structures controlling the lineaments and could be processed for mineral target detection. Author (ESA)

N84-33901# Technical Univ. of Denmark, Lyngby. **STATISTICAL LINEAMENT ANALYSIS IN SOUTH GREENLAND BASED ON LANDSAT IMAGERY**

K. CONRADSEN, G. NILSSON, and T. THYSTED (Geological Survey of Denmark) / In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 281-287 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Linear features, mapped visually from one-channel photoprints (1:1,000,000) of LANDSAT images from South Greenland, were digitized and analyzed statistically. A sinusoidal curve was fitted to the frequency distribution, dividing it into 10 significant classes of directions. Geographically, many of the classes are distributed in zones of geological significance. Zones coincide with geochemical boundaries and graben structures and the crossing points between zones control intrusion sites. Author (ESA)

N84-33902# Delhi Univ. (India). Dept. of Geology. **STUDIES IN ENVIRONMENTAL GEOMORPHOLOGY OF DUDHATOLI RIDGE GARHWAL, HIMALAY, INDIA**

C. PRASAD, R. R. SUNDRIYAL, and V. K. VERMA / In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 289-294 Aug. 1984 refs Sponsored by Indian Department of Environment Prepared in cooperation with Garhwal Univ., India

Avail: NTIS HC A24/MF A01

Dudhatoli Ridge (Himalayas) landforms, vegetation, and soil cover were studied via aerial photograph and LANDSAT images, and field checks. The central part of this ridge is a dome occupied by granitic rocks. It is cut across by a strong lineament, indicating recent tectonic movement along the axis of this synform. This dome is largely without any vegetation and has very thin soil cover, whereas its margins are densely forested, with rich soils. The central part of the ridge is subjected to considerable mass wastings, aided by the presence of crushed rocks along the zone

of recent tectonic dislocation. This is further evidenced by the presence of recent colluvial deposits on the sides of the dome.

Author (ESA)

N84-33983*# Technische Univ., Munich (West Germany). **LASER REMOTE SENSING MEASUREMENTS OF NATURAL TARGET REFLECTIVITIES**

F. LEHAMNN, W. WIESEMANN (Battelle-Institut), M. ROTHER (Battelle Institut), and C. WERNER (DFVLR) / In ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 793-796 Aug. 1984 refs Sponsored by German Federal Ministry for Research and Technology

Avail: NTIS HC A15/MF A01 CSCL 20E

The application possibilities of active infrared spectroscopy to remote sensing of soil and rock types and surface soil moisture was investigated in laboratory work and flight campaigns. For the flight measurements the DIALEX instrument, a profiling laser spectrometer with tunable CO₂-lasers (9 to 11 microns) was used. The differential reflection data of flight measurements agree with laboratory results. The mean deviation between these data is 15%. Especially for large homogeneous test sites like grass land, ploughed fields and lake Ammersee the mean deviation is 15%. Author (ESA)

N84-33984*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

DEMONSTRATION OF AN ACTIVE AIRBORNE IR LASER SYSTEM FOR GEOLOGIC REMOTE SENSING

A. B. KAHLE, M. S. SHUMATE, and D. B. NASH / In ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 797-799 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 20E

Geological units in Death Valley, California were distinguished by differences in their reflectance of thermal infrared radiation emitted by dual airborne CO₂ lasers tuned to 9.23 and 10.27 microns, demonstrating the feasibility of an active, laser remote sensing system. Data obtained with the lasers are highly correlated with imagery of the same area collected with the Thermal Infrared Multispectral Scanner. Author (ESA)

N84-34060 Texas Univ., Austin.

ANALYSIS OF LARAMIDE AND YOUNGER DEFORMATION OF A SEGMENT OF THE BIG BEND REGION, TEXAS Ph.D. Thesis

A. R. MOUSTAFA 1983 278 p

Avail: Univ. Microfilms Order No. DA8414419

Field mapping of the Sierra Del Carmen, Big Bend National Park, and Black Gap Wildlife Management Area shows that the macrostructures in the exposed Cretaceous and younger rocks are persistent zones of west-northwest-oriented strike-slip faults, north-northwest-oriented monoclines, and north-northwest-oriented normal faults. The west-northwest-oriented left-stepped en echelon faults occur in zones about 5.5 km apart. The monoclines decrease in structural relief toward and are bounded by these fault zones. The Laramide compression caused left-lateral convergent wrenching which formed the north-northwest-oriented monoclines, west-northwest-oriented hinge, and a few west-northwest-oriented left-lateral strike-slip faults. Right-lateral divergent wrenching along the west-northwest-oriented faults due to basin-and-range extension formed pull-apart grabens. The west-northwest-oriented fault zones are Laramide and basin-and-range rejuvenation of pre-existing faults. LANDSAT images show a set of right-stepped, en echelon west-northwest-oriented lineament zones in the Trans-Pecos area. Dissert. Abstr.

N84-34719# Eidgenossische Technische Hochschule, Zurich (Switzerland). Inst. fuer Geodaesie und Photogrammetrie.

SPACE LASER APPLICATIONS IN GEOPHYSICS

H. G. KAHLE and F. BARLIER (Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse, France) / In ESA Space Laser Appl. and Technol. (SPLAT) 6 p May 1984 refs

Avail: NTIS HC A14/MF A01

The use of spaceborne lasers to study the Earth's dynamic processes for earthquake prediction is discussed. Apart from fault

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plane solutions of earthquakes, important data sets, from which constraints on deep seated tectonic processes can be derived, include detailed gravity field determination at intermediate wavelengths and precise point-positioning for monitoring changes of very long baselines across major plate boundaries. Geophysical problems related to global geodynamics are defined and geodetic techniques contributing to their solutions are described.

Author (ESA)

N84-34720# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).

EARTH'S ROTATION AND ITS GEOPHYSICAL IMPLICATIONS
F. BARLIER and H. G. KAHLE (Eidgenossische Technische Hochschule, Zurich) / In ESA Space Laser Appl. and Technol. (SPLAT) 3 p May 1984 refs
Avail: NTIS HC A14/MF A01

Determination of the Earth's rotation parameters by laser telemetry is discussed. Laser telemetry data on polar motion, axial spin rate, and recurrent oscillations are presented. Author (ESA)

N84-34808*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOPHYSICAL INTERPRETATION OF SATELLITE LASER RANGING MEASUREMENTS OF CRUSTAL MOVEMENT IN CALIFORNIA

S. C. COHEN Aug. 1984 27 p refs Submitted for publication

(NASA-TM-86148; NAS 1.15:86148) Avail: NTIS HC A03/MF A01 CSCL 08K

As determined by satellite laser ranging the rate of contraction of a 900 kilometer baseline between sites located near Quincy in northern California and San Diego in southern California is about 61 to 65 mm/yr with a formal uncertainty of about 10 mm/yr. The measured changes in baseline length are a manifestation of the relative motion between the North America and Pacific tectonic plates. This long baseline result is compared to measurements made by more conventional means on shorter baselines. Additional information based on seismicity, geology, and theoretical modelling is also analyzed. Deformation lying within a few tens of kilometers about the major faults in southern California accounts for most, but not all of the observed motion. Further motion is attributable to a broader scale deformation in southern California. Data suggesting crustal movements north of the Garlock fault, in and near the southern Sierra Nevada and local motion at an observatory are also critically reviewed. The best estimates of overall motion indicated by ground observations lie between 40 and 60 mm/yr. This lies within one or two standard deviations of that deduced by satellite ranging but the possibility of some unresolved deficit cannot be dismissed. The long time scale RM2 plate tectonic model of Minster and Jordan predicts a contraction between 47 and 53 mm/yr depending on the extension rate of the Basin and Range. Thus the ground based observations, satellite laser ranging (SLR) results, and RM2 rates differ at about the 10 mm/yr level and are consistent with one another within the data and model uncertainties.

Author

N84-35051# National Science Council, Taipei (Taiwan).

THE GEOLOGIC STUDY OF TAIWAN AREA FOLLOWING UP THE ACQUISITION OF TAIWAN SLAR IMAGERY Abstract Only

J. K. LIU / In its Sci. Res. Abstr. in Republic of China, 1983 p 61 Jun. 1984

Avail: Issuing Activity

The general uses of SLAR imagery is investigated. Additional geologic data of the Central Mountain Range of Taiwan is presented. (1) The potential applications and related factors and parameters are studied and discussed in detail; an interpretation chart is worked out. Two main programs and four subroutines are set up to assist the analysis of SLAR lineaments and drainages. (2) SLAR lineaments reveal that there are four major sets of geologic structures on Taiwan Area, i.e., N29 deg E, N72 deg E, N30 deg W, and N66 deg W; nevertheless, only the N29 deg E trend was known previously. Through this study, the regional stress

direction is concluded to be 125 deg in azimuth. Two tectonic patterns are discovered, the circular patterns surrounding Peikang Basement High and the NW/SE shear zone crossing the middle part of Taiwan Island.

M.A.C.

N84-35052# National Central Univ., Chung-Li (Taiwan).

THE GEOLOGIC AND GEOPHYSICAL STUDY OF THE HENGCHUNG PENINSULA, SOUTHERN TAIWAN, 1 Abstract Only

T. P. YEN, Y. H. TZOU, and K. C. SUNG / In National Science Council Sci. Res. Abstr. in Republic of China, 1983 p 62-63 Jun. 1984

Avail: Issuing Activity

A geophysical survey of the Hengchung Peninsula in southern Taiwan is presented. Topics include stratigraphy, aerial and satellite photoreconnaissance and the geomagnetism of the region.

M.A.C.

05

OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A84-39943#

A CLIMATOLOGICAL ESTIMATE OF PRECIPITATION FOR THE WORLD OCEAN

W. P. ELLIOTT (NOAA, Environmental Research Laboratories, Rockville, MD) and R. K. REED (NOAA, Pacific Marine Environmental Laboratory, Seattle, WA) / Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 23, March 1984, p. 434-439. refs

Climatological estimates of mean annual precipitation over the world ocean are presented and discussed. A value for mean annual oceanic precipitation (between 65 deg N and 60 deg S) of 93 cm is obtained which is smaller than some other estimates. These results are supported by a recent analysis of tropical rainfall based on satellite techniques. Aspects of the need for and utility of climatological information are discussed.

Author

A84-40167#

THE ERS-1 PROGRAMME OF THE EUROPEAN SPACE AGENCY - ITS APPLICATIONS TO MINERAL AND MARINE RESOURCES, METEOROLOGY, CLIMATOLOGY, AND OCEANOGRAPHY

C. HONVAULT (ESA, Directorate of Applications Programmes, Toulouse, France) / In: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 185-193.

The ERS-1 satellite program being undertaken by ESA is reviewed. Plans call for a payload comprising radar altimeter, active microwave instrumentation (SAR; wind and wave scatterometers), and further instruments to be specified later; a launch date in 1987 for a 3-yr mission; a circular sun-synchronous orbit at 650-700 or 775 km; and high and low bit rates for data transmission. The ground segment, overall mission capabilities, and applications in ocean forecasting, marine transportation, oceanography, and meteorology and climatology are characterized.

T.K.

A84-40171#

MONITORING MARINE POLLUTION BY AIRBORNE REMOTE SENSING TECHNIQUES

Y. SHUN, Q. ZHENG (National Bureau of Oceanography, First Institute of Oceanography, Qingdao, People's Republic of China), and X. TENG (Chinese Academy of Sciences, Changchun Institute of Physics, Changchun, People's Republic of China) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 239-248. refs

A84-40185#

OPTIMUM ASSESSMENT OF SUBSURFACE WATER PARAMETERS USING RADIANCE MEASUREMENTS FROM SPACE

S. UENO and Y. KAWATA (Kanazawa Institute of Technology, Kanazawa, Japan) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 409-421. refs

A method for computing ordinary and inverse initial-value solutions for the transfer equation of radiation in the atmospheric-ocean system is presented, in order to remove atmospheric blurring effects from oceanic remote sensing imagery. A contour map of readjusted digital counts near Kanazawa harbor in the Hokuriku region of Japan is presented, as well as an associated map of the albedo of the sea surface. The maps are found to be useful in monitoring flow patterns and in providing the relative detailed features of turbidity in coastal waters, allowing for the logarithmic relation between diffuse reflectance and suspended sediment concentration. I.H.

A84-40193#

IMPACTS OF CLIMATE ON VARIATIONS IN SUMMER ICE COVER IN THE CANADIAN ARCTIC

B. DEY (Howard University, Washington, DC) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 529-537. refs

The present investigation is concerned with the impact of climatic elements on the variations in summer ice cover in the Canadian Arctic during two markedly different but consecutive years, including 1976 and 1977. The main source of sea ice information was provided by satellite images. Other data were obtained from the Atmospheric Environment Service (AES) and the Monthly Weather Review. An analysis of the data indicates that the climatic elements of 1000-millibar atmospheric flow patterns and the surface temperatures have significant impacts on variations of sea ice cover, especially over the Beaufort Sea sector of the Canadian Arctic. G.R.

A84-40198#

MICROWAVE RADIOMETRIC MAPPING OF OCEANOGRAPHIC AND ATMOSPHERE PARAMETERS BASED ON SATELLITE MONITORING

N. A. ARMAND, V. F. KRAPIVIN, B. G. KUTUZA, F. A. MKRTCHIAN, and B. L. PETRENKO (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 585-594. refs

The study of the environment on a global scale makes it necessary to organize global monitoring systems. One of the principal objectives of such systems is related to the detection and identification of anomalies, taking into account pollution conditions, fires, typhoons, hurricanes, and tropical cyclones. The detection of such anomalies requires the employment of special automatic equipment for the processing of the large data sets

provided by satellite measurements. Procedures must be organized for in-line data processing at all detection system levels. The effectiveness of search system operation will depend in particular on the design of the selection algorithm for 'suspected' elements. G.R.

A84-40208#

A SYNOPTIC APPROACH TO STUDYING CHANGES IN SEA SURFACE TEMPERATURE USING GEOSTATIONARY SATELLITE DATA

M. R. STEVENSON (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Sao Paulo, Brazil) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 703-714. refs

A84-40210#

REMOTE-SENSING OBSERVATION OF GLACIERS TOWARDS THEIR MONITORING

A. DELLA VENTURA, A. RAMPINI (CNR, Istituto di Fisica Cosmica, Milan, Italy), R. RABAGLIATI (IBM Italia S.p.A., Mestre, Italy), and R. SERANDREI BARBERO (CNR, Istituto per lo Studio della Dinamica delle Grandi Masse, Venice, Italy) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 723-733. refs

Landsat MSS images are used to locate and characterize six glaciers in the Disgrazia Group in the Central Alps. Images obtained at the end of the ablation period in 1975, 1978, and 1980 are processed to remove 6-line stripings; the channel-5 and channel-7 images are multiplied digitally and normalized to the maximum channel-5 level to facilitate discrimination of the glacier areas; the combined image is subdivided into strips for which mean and median are computed; and threshold functions permitting the location of both the glaciers and their transient snowlines are obtained. Glacier surface areas are calculated using published mean-inclination data, and morphological features are classified using linguistic pattern-recognition techniques. Sample data are presented in tables, radiance histograms, grey-level maps, and structural descriptions and compared with ground-truth data and aerial photography: good agreement is found. T.K.

A84-40218#

REMOTE SENSING OF SNOW AND ICE USING NIMBUS-7 SMMR DATA OVER FINLAND

M. T. HALLIKAINEN IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 821-830. refs

Nimbus-7 SMMR data at 18 GHz and 37 GHz are applied to studies of snow-covered sea ice and snow-covered terrain in Finland. First, the dielectric properties of sea ice, snow, and frozen soils are reviewed. Brightness temperatures are calculated using the radiative transfer model. The theoretical results show that snow-covered sea ice and snow-covered terrain are practically identical systems. The only major difference is the presence of vegetation in the case of terrain. Using horizontally polarized satellite data in five test areas of mixed surface types in Finland, slopes of the change of $T_{sub B}(18 \text{ GHz}) - T_{sub B}(37 \text{ GHz})$ vs water equivalent of dry snow are derived for pure surface types of forests, boglands, farmlands, and lakes. A new algorithm for mapping the water equivalent of dry snow is suggested. The theoretical model is used to interpret the satellite data on snow-covered sea ice. Author

A84-40227#

AN APPROACH TO OPTICAL AIR-TRUTH

K. MUNEYAMA, Y. SASAKI (Japan Marine Science and Technology Center, Yokosuka, Japan), and Y. TAKAHASHI (Asia Air Survey Co., Ltd., Tokyo, Japan) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 923-929. Research sponsored by the Science and Technology Agency of Japan.

A method for eliminating atmospheric influences in MSS data is evaluated. The method incorporates parameters for the variable atmospheric extinction and direct-diffuse radiation components of solar irradiance on the surface of the earth. The method was tested by measuring direct and global solar radiation over Tokyo Bay, at an altitude of 12,000 feet. It is found that atmospheric influences strongly depend upon direct solar irradiance, which is in turn dependent upon atmospheric optical conditions such as extinction coefficients. By removing atmospheric influence from the MSS data, more accurate measurements of optical air-truth were obtained. I.H.

A84-40228#

ACCURACY OF DIRECT MEASUREMENT OF MEAN SURFACE WATER VELOCITY OF THE KUROSHIO USING MULTI-TEMPORAL NOAA-6 IMAGERIES

S. TANAKA, T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo, Japan), T. NISHIMURA (Tokyo, Science University, Noda, Chiba, Japan), and Y. HATAKEYAMA (Asia Air Survey Co., Ltd., Atsugi, Kanagawa, Japan) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 933-944. refs

A84-40367

ATMOSPHERIC LEE WAVES IN THE AEGEAN SEA AND THEIR POSSIBLE INFLUENCE ON THE SEA SURFACE

L. WALD (Paris, Ecole National Supérieure des Mines, Valbonne, Alpes-Maritimes, France) and D. GEORGOPOULOS (Institute of Oceanographic and Fisheries Research, Athens, Greece) Boundary-Layer Meteorology (ISSN 0006-8314), vol. 28, Mar.-Apr. 1984, p. 309-315. refs

Unusual satellite images of the Aegean Sea, in both the visible and infrared ranges, are discussed. Alternating bright and dark features downwind of islands suggest the presence of atmospheric lee waves. However, close examination of these features indicates that the observed signal is likely the signature of the influence of the lee waves on the sea surface rather than the signature of the lee waves themselves through atmospheric effects. Author

A84-40382

SARSCAT, A COMPUTER-CONTROLLED MICROWAVE RADAR SYSTEM FOR OCEANOGRAPHIC MEASUREMENTS - DESCRIPTION OF THE COHERENT RADAR SENSOR [SARSCAT, EIN RECHNERGESTEUERTES MIKROWELLEN-RADARSYSTEM FUER OZEANOGRAPHISCHE MESSUNGEN - BESCHREIBUNG DES KOHERENTEN RADARSENSORS]

D. HOUNAM (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany), W. POETZSCH, W. SCHWIMMER, and K. H. WAEGEL IN: Radar technology 1983; Symposium, 5th, Munich, West Germany, November 8-10, 1983, Reports. Duesseldorf, West Germany, Deutsche Gesellschaft fuer Ortung und Navigation, 1983, p. 9.1-9.18. In German.

The SARSCAT, an impulsive radar device working in the L band, is described. The device operates in two modes and can be used as a two-frequency scatterometer as well as a simple synthetic aperture radar. It is suitable for use in aircraft and for stationary measurements. Its main use is for the measurement of backscattering characteristics from the ocean surface. The design

of the radar instrument is addressed, including the transmitter-receiver slide-in unit, the frequency processing, the impulse generator, and the computational circuit. The receiver gain plan is summarized, and the use of SARSCAT for static measurements is discussed. C.D.

A84-40383

SARSCAT, A COMPUTER-CONTROLLED MICROWAVE RADAR SYSTEM FOR OCEANOGRAPHIC MEASUREMENTS - SYSTEM CONCEPT AND FIRST MEASURED RESULTS [SARSCAT, EIN RECHNERGESTEUERTES MIKROWELLEN-RADARSYSTEM FUER OZEANOGRAPHISCHE MESSUNGEN - SYSTEMKONZEPT UND ERSTE MESSERGEBNISSE]

N. BARTSCH, H. J. MUELLER, and R. SCHMID (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) IN: Radar technology 1983; Symposium, 5th, Munich, West Germany, November 8-10, 1983, Reports. Duesseldorf, West Germany, Deutsche Gesellschaft fuer Ortung und Navigation, 1983, p. 10.1-10.19. In German. refs

Preliminary results for SARSCAT are presented. The system has up to now used only a two-frequency scatterometer; the procedure for this use is presented. The SARSCAT system concept is described, including its arrangement aboard aircraft, its operational software, and the computational part. The first measurement runs are described, as is the processing of the results. Doppler spectra are presented. C.D.

A84-40543

IDENTIFICATION OF SUSPENDED SEDIMENT IN COASTAL WATERS USING AIRBORNE THEMATIC MAPPER DATA

M. COLLINS and C. PATTIARATCHI (Swansea, University College, Swansea, Wales) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 635-657. Research supported by the Natural Environment Research Council. refs

Over Swansea Bay, UK, the Landsat-4 thematic mapper (TM) system imaged the sea surface along seven north-south lines at an altitude of 4000 m with a resolution of 10 m. Fifty-eight surface/near surface water-sediment samples were collected from three vessels. They were filtered, measured and compared with an 11-channel TM data set. Test were conducted to examine the bandwidth response to suspended sediment in the surface waters. Concentrations of sediment show up more clearly in channels 2-5 of the airborne mapper. Variability in reflectivity analyses were carried out in channels 2 (450-520 nm), 3 (520-600 nm), 4 (605-625 nm), 5 (630-690 nm). Measured suspended sediment concentrations range from 1.9 to 20.8 mg/l. Some advantages in the use of airborne systems, in areas such as Swansea Bay, are the opportunity for surveys to be carried out several times at various tidal states and phases. J.P.

A84-41046* Harvard Univ., Cambridge, Mass.

A STUDY OF THE VARIABILITY OF OCEAN CURRENTS IN THE NORTHWESTERN ATLANTIC USING SATELLITE ALTIMETRY

A. R. ROBINSON (Harvard University, Cambridge, MA), N. E. HUANG, C. D. LEITAO, and C. G. PARRA (NASA, Wallops Flight Center, Wallops Island, VA) Journal of Physical Oceanography (ISSN 0022-3670), vol. 13, April 1984, p. 565-585. refs (Contract NSG-5228; N00014-74-C-0225)

Altimeter data obtained from GEOS-3 during the three year period 1975-78 for a region of the western North Atlantic which includes a portion of the Gulf Stream system and part of the open ocean area of the subtropical gyre are analyzed by a new technique which utilizes all the points along the satellite tracks. The physical phenomenon studied are the time-variable but almost geostrophic currents, or mesoscale eddies, so that geoid errors contaminate the scientific signal minimally and the dynamical interpretation is direct. Results presented include the spatial distribution of geostrophic eddy kinetic energy and examples of a

synoptic map of the eddy field (April 1977) and of a time series at a point. These results are compared to and synthesized with a diverse and select set of existing measurements and observations obtained in situ by a variety of instrumental techniques. The agreement is generally good, and the altimeter data analyzed provides new information on features in the map of mean eddy kinetic energy. The implications are that satellite altimetry will serve as a powerful quantitative tool in eddy current research and that even presently archived data contains further useful scientific information. Author

A84-41978

PHOTOGRAMMETRIC METHODOLOGY TO LITTORAL STUDIES, PHOTOINTERPRETATION IN ATHOS PENINSULA, GREECE

E. PATMIOS, M. TSAKIRI-STRATI, O. GEORGOULA, and M. LASARIDOU (Salonika, University, Salonika, Greece) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 287-292. refs

Photointerpretation on Athos peninsula in Chalkidiki, in Greece, is considered. The study involves air photographs in scale 1:60,000, 1:20,000. It refers to such factors that influence coasts as mountain crests, inclinations, and drainage. It also refers to landslide phenomena and the possibilities of approaching coasts. A discrimination of the various smoothness of coasts is done. The possibilities of observation with or without dioptrics x3 and x8 are being searched through. The particular importance of photointerpretation is recognized in order to evaluate alignment and altimetric details to draw conclusions about coast generation and evaluation. The importance of the Athos peninsula is emphasized also because of the existence of various monasteries of enormous historical and cultural interest. A relevant example is given about it. Aspects based on photointerpretation for further photogrammetric research are commented. Author

A84-41995

IN SITU WATER QUALITY DATA ACQUISITION FROM A HELICOPTER

M. I. OZONE (King Saud University, Riyadh, Saudi Arabia) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 493-501.

A water quality analyzer with a 150-m-long sensor cable has been mounted on a helicopter as a platform to lower the sensors down in the water and measure in situ physico-chemical parameters of water samples from different depths in Kuwaiti waters. Data collected have been intended to serve as ground truth for correlation of environmental conditions with color and density measurements in a scene. Five parameters, namely, temperature, pH, conductivity, dissolved oxygen, and the depth of a sample, are recorded on board the helicopter. To examine the merit of plane measurements, some data have been collected using the conventional techniques from a boat. These two sets of measurements are compared and evaluated as for effectiveness and cost. Plane measurements are found accurate and cost effective under Kuwaiti environmental conditions. Author

A84-42089

OCEAN TIDAL PERTURBATIONS ON THE ORBIT OF THE SATELLITE 'STARLETTE'

M.-F. HE (Astronomical Observatory, Shanghai, People's Republic of China) Chinese Astronomy and Astrophysics (ISSN 0275-1062), vol. 8, June 1984, p. 113-118. Translation. refs

The results of 300 days of worldwide laser ranging of the Starlette satellite to assay orbital perturbations due to ocean tides are reported. A total of 66,012 rangings were made from 10 tracking stations. A numerical model was defined to characterize the ocean tidal potential as an expression of the Starlette orbital elements. Consideration is confined to perturbations on the six orbital elements lasting more than one day. Account is taken of the earth's shape, air drag, solar and lunar gravity, solar radiation pressure, body tide and ocean tide. The tides were found to produce effects on the scale of meters within 5 days, implying that ocean tides must be considered if decimeter accuracy is desired when calculating orbital elements. M.S.K.

A84-42211

CHARACTERIZATION OF SEA ICE TYPES USING SYNTHETIC APERTURE RADAR

J. D. LYDEN, B. A. BURNS (Michigan, Environmental Research Institute, Ann Arbor, MI), and A. L. MAFFETT (Michigan, University, Dearborn; Michigan, Environmental Research Institute, Ann Arbor, MI) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-22, Sept. 1984, p. 431-439. refs (Contract N00014-81-C-0295)

The vertical and horizontal extent of sea ice is an important factor for offshore activities and ship navigation in polar regions. It is necessary to distinguish between open water and two types of ice, including multiyear (MY) ice and first-year (FY) ice. The present investigation is concerned with the determination of optimum SAR imaging parameters for sea ice mapping, and with the development of quantitative classification methods which are suitable for automatic interpretation of SAR ice data. A description is given of results which begin to provide some insight into the solution of the considered problems. A quantitative examination of simultaneously collected four-channel SAR imagery of sea ice in the Beaufort Sea indicated that relatively short wavelengths and steep incidence angles provide the greatest amount of information on sea ice types. However, more research is needed to develop satisfactory quantitative measures for ice-type discrimination. G.R.

A84-42311* National Marine Fisheries Service, Bay Saint Louis, Miss.

ZONES OF COASTAL HYPOXIA REVEALED BY SATELLITE SCANNING HAVE IMPLICATIONS FOR STRATEGIC FISHING

T. D. LEMING (NOAA, National Marine Fisheries Service, Bay Saint Louis, MS) and W. E. STUNTZ (NASA, National Space Technology Laboratories, Pascagoula, MS) Nature (ISSN 0028-0836), vol. 310, July 12, 1984, p. 136-138. refs

Little is known about the spatial and temporal scales of hypoxic bottom water areas that occur along the inner continental shelf of Texas and Louisiana. Because hypoxia appears to be related to surface chlorophyll and temperature, which can both be measured with the Coastal Zone Color Scanner aboard the Nimbus 7 satellite, an attempt has been made to determine whether conditions favorable for the formation of hypoxia could be detected and monitored from space. A linear discriminant function has identified areas of bottom water hypoxia detected by research vessels up to 10 days after satellite overpass, and predicted hypoxic areas without resort to research vessel data. Such space mapping may be of consequence for marine resource management and exploitation. O.C.

05 OCEANOGRAPHY AND MARINE RESOURCES

A84-42496* Washington Univ., Seattle.

MEASURING THE SEA ICE FLOE SIZE DISTRIBUTION

D. A. ROTHROCK (Washington, University, Seattle, WA) and A. S. THORNDIKE (Journal of Geophysical Research (ISSN 0148-0227), vol. 89, July 20, 1984, p. 6477-6486. refs (Contract NAG5-160; N00014-76-C-0234)

The sea ice covering the Arctic Ocean is broken into distinct pieces, called floes. In the summer, these floes, which have diameters ranging up to 100 km, are separated from each other by a region of open water. In the winter, floes still exist, but they are less easily identified. An understanding of the geometry of the ice pack is of interest for a number of practical applications associated with transportation in ice-covered seas and with the design of offshore structures intended to survive in the presence of ice. The present investigation has the objective to clarify ideas about floe sizes and to propose techniques for measuring them. Measurements are presented with the primary aim to illustrate points of technique or approach. A preliminary discussion of the floe size distribution of sea ice is devoted to questions of definition and of measurement. G.R.

A84-43203

CURRENTS OF MUSHROOM SHAPE IN THE OCEAN (ACCORDING TO AN ANALYSIS OF SATELLITE IMAGES) [GRIBOVIDNYE TECHENIIA V OKEANE /PO DANNYM ANALIZA SPUTNIKOVYKH IZOBRAZHENII/]

A. I. GINZBURG and K. N. FEDOROV (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 18-26. In Russian. refs

An analysis of satellite images of the Baltic Sea, the Sea of Japan, the Black Sea, and areas off the coasts of Kamchatka and Iceland reveals the existence of currents of mushroom shape. In the plane, these currents can be viewed as a jet terminating in a pair of symmetrically situated eddies of opposite sign (cyclonic and anticyclonic). The characteristic dimensions of these structures are estimated, and the possible mechanisms for their formation are investigated along with the conditions of their detectability in the visible range of the spectrum (the presence of natural tracers) and on IR images. B.J.

A84-43209

NONTHERMAL RADIO EMISSION OF INTENSELY DEFORMING ICE COVERS OF NATURAL WATERS [NETEPLVOE RADIOIZLUCHEENIE INTENSIVNO DEFORMIRUIUSHCHIKHSIA LEDIANYKH POKROVOV ESTESTVENNYKH VODOEMOV]

L. G. KACHURIN, V. F. PSALOMSHCHIKOV, and I. A. STEPANIUK (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 60-65. In Russian. refs

An investigation was made of pulsed nonthermal radio emission from deforming ice cover, where the intensity of this emission increases with the degree of deformation. Airborne and ground measurements were performed in the 0-20 and 50-150 kHz ranges. Attention is given to the possibility of the remote sensing of ice covers of natural waters on the basis of nonthermal radio emission. B.J.

A84-43851

SPACE OCEANOGRAPHY; SUMMER SCHOOL, GRASSE, ALPES-MARITIMES, FRANCE, JULY 1-28, 1982, LECTURES [L'OCEANOLOGIE SPATIALE; ECOLE D'ETE, GRASSE, ALPES-MARITIMES, FRANCE, JULY 1-28, 1982, COURS MAGISTRAUX]

Summer School sponsored by the Centre National d'Etudes Spatiales. Toulouse, Cepadues-Editions, 1984, 888 p. In French and English. For individual items see A84-43852 to A84-43862.

Satellite-based oceanography, remote sensing, and geodesic studies of the oceans are presented. Particular note is taken of analytical models of ocean circulation and dynamics and the data available from instrumentation such as carried by Seasat. Techniques for microwave remote sensing and models for the dynamics of sea ice are discussed, as are the Argos (Tiros-N)

data acquisitions system, tidal zone altimetry, and chromatic visible wavelength remote sensing of the ocean. Progress on development and mission definition for the European Remote Sensing Satellite is assessed, and the capabilities of Seasat altimeter, scatterometer, and microwave radiometer for measuring the ocean topography, surface winds, currents and sea state are analyzed. Finally, the state of the art of techniques for characterizing the ocean geoid is examined, with particular reference to available satellite capabilities. M.S.K.

A84-43852

THE OCEAN CIRCULATION AND ITS MEASUREMENT FROM SPACE

C. WUNSCH (MIT, Cambridge, MA) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures. Toulouse, Cepadues-Editions, 1984, p. 13-67. refs

Analytical models and measurement techniques are delineated for characterizing the global oceanic circulation patterns, which are driven by wind stress and solar thermal input. Modeling the circulation is important to understand the related climatic effects, trace the chemical exchanges with the atmosphere and land run-off, and map the movements of protein sources such as fish. The beta-plane, vorticity dynamics, Ekman theory, and Sverdrup relation models for the general circulation and frictional and inertial models of western boundary currents are reviewed. Attention is given to topographic, baroclinic and thermohaline effects on circulation and to methods of studying the forcing and flow thermal wind and accounting for a lack of motion in some areas. Satellite observation, confined to surface measurements, can be useful in the form of altimetry to establish the geoid and scatterometers to monitor circulation and the wind stress. M.S.K.

A84-43853

MICROWAVE REMOTE SENSING AND DYNAMICS OF SEA ICE

W. J. CAMPBELL (Puget Sound, University, Tacoma, WA) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures. Toulouse, Cepadues-Editions, 1984, p. 477-524. refs

The state of the art of knowledge of snow and ice behavior in the Arctic and Antarctic, and available monitoring capabilities and numerical models for interpreting satellite data are surveyed, together with ongoing and planned data gathering programs. Attention is given to the history of cryosphere exploration and mapping up to the present. NASA has initiated the ISEX program to deploy four microwave and one laser ranging satellites dedicated to snow and ice studies in the near future. The surveys performed and planned cover sea ice, ice sheets, and snow cover with both active and passive instrumentation. Seasat provided data for validating algorithms for tracking sea ice using satellite SAR imagery. M.S.K.

A84-43854

THE ARGOS SYSTEM FOR LOCALIZATION AND DATA ACQUISITION [LE SYSTEME DE LOCALISATION ET COLLECTE DE DONNEES ARGOS]

J.-C. HUSSON and J.-L. BESSIS (Centre National d'Etudes Spatiales, Toulouse, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures. Toulouse, Cepadues-Editions, 1984, p. 601-617. In French.

The Argos satellite-sea buoy system for atmospheric and oceanic data acquisition and relay with precise point-of-origin coordinates is described. Argos consists of two Tiros-N spacecraft, buoy-based beacons, receiver antennas and data treatment and retransmission apparatus, and data handling facilities in Washington and Toulouse. The beacons transmit sensor data in either digital or analog formats at 401.650 MHz in subsecond bursts, allowing for a high throughput. Tiros-N satellites travel 830 km altitude orbits with 101 min periods, 98 deg inclination and relay the buoy signals. Doppler shifts in signals to two different satellite positions provide coordinates for the beacons. The system was devised to measure sea surface wave heights, ocean geoid levels, tides and

currents, ocean temperatures and salinity, and the ambient acoustic noise. M.S.K.

A84-43855

SATELLITE ALTIMETRY OF THE TOPOGRAPHY OF THE FREE OCEAN SURFACE IN THE COASTAL ZONE [MESURE ALTIMETRIQUE PAR SATELLITE DE LA TOPOGRAPHIE DE LA SURFACE LIBRE DE LA MER EN ZONE LITTORALE]

C. LE PROVOST (Grenoble, Institut de Mecanique, Grenoble, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures . Toulouse, Cepadues-Editions, 1984, p. 619-642. In French. refs

The data base on tidal characteristics is reviewed and applied to assessing the capability of mapping coastal tides using Seasat radar altimetry. Tidal characteristics are caused by luni-solar forces and exhibit quasi-periodic behavior on a number of temporal scales. A numerical model has been defined and accounts for instantaneous surface gradients, the average surface position, astronomical forces and frequencies and the amplitudes and phase of each component. The 3.125 nsec Seasat radar altimeter pulses with readings taken every 0.7 km of surface track are integrated over the height of a reference ellipsoid, altimetric height, measured sea surface height over the reference height and height of the sea surface over a reference geoid. Account is taken of the tidal state and meteorological conditions. Analyses of data from Bermuda and the English Channel shoreline show 1 m tidal accuracy is attainable. M.S.K.

A84-43857

STATUS AND FUTURE PLANS FOR THE FIRST EUROPEAN REMOTE SENSING SATELLITE ERS-1

G. PACI (ESA, Toulouse, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures . Toulouse, Cepadues-Editions, 1984, p. 689-699.

The instrumentation, space, launch vehicle, and ground segments for the ERS-1 remote sensing satellite system are outlined. Scheduled for Ariane launch in 1987, ERS-1 will carry a C-band radar microwave emitter to combine SAR, wave scatterometer and wind scatterometer functions, a Ku-band radar altimeter, laser retroreflectors, a three-channel radiometer, and a two-way X-band RF range and range rate experiments. ERS-1 will monitor coastal zones, global ocean processes and polar regions, sea-ice movements, sea states, and surface winds. Data will be received at Kiruna and transmitted to a processing center. The data will then be dispensed raw, in a quasi-real time format or several weeks later in a thematic format. ERS-1 is a prototype for a constellation of satellites that would be launched in the 1990s. M.S.K.

A84-43858

TOPOGRAPHY OF THE OCEAN FROM SEASAT ALTIMETER DATA [TOPOGRAPHIE DE LA MER APARTIR DES DONNEES ALTIMETRIQUES SEASAT]

Y. MENARD (Centre National d'Etudes Spatiales, Groupe de Recherches de Geodesie Spatiale, Grasse, Alpes-Maritimes, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures . Toulouse, Cepadues-Editions, 1984, p. 701-721. In French. refs

The progress in satellite-based altimeter mapping of sea surface heights over the last decade is examined and Seasat capabilities are quantified. Seasat radar altimetry had a 7 cm noise level in height measurements, compared to Skylab 1 m and GEOS 30 cm noise levels. The data aids in characterization of the ocean height with respect to a reference ellipsoid and the effects of circulation, tides and atmospheric pressure. A geostrophic approach, involving the Navier-Stokes equations, has been used for modeling ocean current effects, but does not account for viscosity, the Rossby number and local deflections. Corrections have been devised for the time of return of an emitted signal, pointing distance, and the distance between the center of gravity of the satellite and the sensors. Seasat measures an area 700 km on a side and was used to track the Gulf Stream and Kuroshio currents, as well as the altitudes of the Atlantic and Pacific sea surfaces. M.S.K.

A84-43860

MICROWAVE SENSORS IN SPATIAL OCEANOGRAPHY [LES SENSEURS HYPERFREQUENCES EN OCEANOGRAPHIE SPATIALE]

N. LANNELONGUE (Centre National d'Etudes Spatiales, Toulouse, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures . Toulouse, Cepadues-Editions, 1984, p. 747-763. In French.

The effects of the sea surface on the backscattered microwaves are summarized as a guide to the design of new remote sensing satellites for oceanography. Attention is focused on SAR applications. Microwaves penetrate the sea only a few millimeters and can thus return data on wind-generated waves, gravity waves, and internal waves (interactions of ocean currents). Data processing must account for the angle of incidence of the microwave, its frequency, and polarization. The return signals are affected by the surface winds, view angle, sea surface temperature and turbulence levels, and the surface pressure. Altimetric measurements are additionally affected by wave heights and the satellite distance from the ocean. Finally, details of the Poseidon altimeter and Seasat SAR and scatterometer systems are described. M.S.K.

A84-43861

THE SEA STATE AND SURFACE WIND SPEED FROM SEASAT ALTIMETER DATA [ETAT DE LA MER ET VITESSE DU VENT DE SURFACE APARTIR DES DONNEES ALTIMETRIQUES DE SEASAT]

P. QUEFFEULOU (Centre National pour l'Exploitation des Oceans, Brest, France) IN: Space oceanography; Summer School, Grasse, Alpes-Maritimes, France, July 1-28, 1982, Lectures . Toulouse, Cepadues-Editions, 1984, p. 809-841. In French. refs

The applications of satellite altimetry to determining the sea state and surface wind speeds are explored, based mainly on experience with Seasat instrumentation. A 400 MHz-30 GHz signal intersects a surface of random roughness. The backscattered signal power is proportional to the number of specular point sources and the mean curve of the surface of the points. Numerical models are defined for extracting wave heights from the backscattered signal and wind speeds from the extent of diffusion of the backscattered signals. Simple calculations are provided for defining sea state characteristics during a storm and surface wind speeds using Seasat data. The results obtained are suitable for use as initial conditions in climatological models. M.S.K.

A84-43951

REMOTE SENSING APPLICATIONS IN MARINE SCIENCE AND TECHNOLOGY; PROCEEDINGS OF THE ADVANCED STUDY INSTITUTE, DUNDEE, SCOTLAND, AUGUST 1-21, 1982

A. P. CRACKNELL, ED. (Dundee, University, Dundee, Scotland) Conference sponsored by NATO, British Tourist Authority, Council of Europe, European Association of Remote Sensing Laboratories, and ESA. Dordrecht, D. Reidel Publishing Co. (NATO Advanced Study Institutes Series. Volume C106), 1983, 477 p. For individual items see A84-43952 to A84-43969.

An overview regarding the remote measurement of the ocean is presented, and NOAA's activities in the field of marine remote sensing are considered along with status and future plans for the first European remote sensing satellite ERS-1, digital image processing, selected topics of coastal zone color scanner data evaluation, and surface wind vector measurements from satellites. Attention is given to the measurement of oceanographic parameters using dekametric radar, remote sensing via meteor trails, the sea surface temperatures from infrared measurements, remote sensing of biological substances, ocean color studies in the Arabian Sea, Landsat application to suspended sediments evaluation, light emerging from the sea and its interpretation and uses in remote sensing, and the detection of marine contours from Landsat film and tape. Other topics discussed are related to oceanography from space, airborne remote sensing and experiments with fluorescent tracers, and the use of an aerial infrared survey in identifying roof structures of high 'U' value in an extensive building complex. G.R.

A84-43952

REMOTE MEASUREMENT OF THE OCEAN - AN OVERVIEW

J. R. APEL (Johns Hopkins University, Laurel, MD) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 1-16.

It is pointed out that the ocean plays as fundamental a role in the natural scheme of things as does the atmosphere. However, difficulties in obtaining detailed, timely information have prevented an effective monitoring and forecasting system for the ocean. Planetary observations of the surface of the sea conducted with the aid of satellites can provide information of much value to the advance of science. In research areas the disciplines served with some degree of usefulness are marine geodesy and gravity, ice dynamics, boundary layer meteorology, climate dynamics, and physical, geological, and biological oceanography. An improved data base and more accurate marine forecasts would be useful for various marine operations, shipping, offshore mining, oil drilling, and fishing. Attention is given to satellites of utility in oceanography, ocean-related spacecraft activities in the next decade, spaceborne sensors for ocean remote measurement, and sources of oceanographic satellite data. G.R.

A84-43953

NOAA'S ACTIVITIES IN THE FIELD OF MARINE REMOTE SENSING

B. H. NEEDHAM (NOAA, Satellite Data Services Div., Washington, DC) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 17-28.

The U.S. National Oceanic and Atmospheric Administration's (NOAA) Satellite Data Services Division (SDSD), part of the Environmental Data and Information Service's (EDIS), National Climatic Center (NCC), represents an unique archive of data and products from NOAA's operational geostationary and polar orbiting satellites, and several of NASA's experimental satellites. The SDSD archive, containing photographic imagery, paper charts, and digital data tapes, dates from April 1960 to the present. The remainder of this report shall highlight these satellite systems, sensors, data reception and archiving, products, services and future plans.

Author

A84-43954

DATA ACQUISITION AND QUALITY

A. P. CRACKNELL (Dundee, University, Dundee, Scotland) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 35-66. refs

A description is presented of the physical nature and quality of the data obtainable from remote sensing satellites. The satellite systems relevant to marine environmental remote sensing are discussed, taking into account GOES-E, GOES-W, Meteosat, Landsat, Tiros-N, Nimbus-7, Seasat, the Heat Capacity Mapping Mission, the French Spot program, and the ERS-1. Active and passive sensors are considered along with the important quantities which have to be measured, giving attention to spectral resolution, spatial resolution, frequency of coverage, and relevant and irrelevant data. The Meteosat and Argos data collection systems are also examined. The Argos system involves the polar-orbiting satellites of the Tiros-N, NOAA-6, and NOAA-7 series. This system makes it possible to receive data from buoys drifting in the Pacific Ocean. Information regarding the satellite data sources is also provided. G.R.

A84-43955

STATUS AND FUTURE PLANS FOR THE FIRST EUROPEAN REMOTE SENSING SATELLITE ERS-1

G. PACI (ESA, Toulouse, France) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 67-81.

The decision to initiate the first ESA Remote Sensing Satellite (ERS-1) program was made on October 28, 1981. Objectives of this satellite mission are related to an enhancement of the scientific understanding of coastal zone and global ocean processes, the monitoring of the polar region in connection with climate research, and the development of economic/commercial applications based on a better knowledge of ocean parameters and sea-state conditions. ERS-1 is to be launched in 1987. Its operation is to prepare the way for a fully operational multisatellite system in the 1990's. Attention is given to a payload description, launch details, aspects of orbit configuration, the ground segment concept, the development plan, and future plans for ERS-1. G.R.

A84-43964

LANDSAT APPLICATION TO SUSPENDED SEDIMENTS EVALUATION

I. V. MURALIKRISHNA (National Remote Sensing Agency, Dept. of Space, Secunderabad, India) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 317-322. refs

Suspended sediments affect aquatic environment. In the visible range, the suspended sediment concentration can be correlated with the reflectance level. A ratio of Landsat MSS bands is used to develop a model for the evaluation of the suspended sediment concentration. A six-level color-coded contour map of the surface distribution of suspended sediments off Saurashtra coast in Arabian sea is obtained using the proposed model. Author

A84-43965

LIGHT EMERGING FROM THE SEA - INTERPRETATION AND USES IN REMOTE SENSING

S. SATHYENDRANATH and A. MOREL (Paris VI, Universite, Paris, France) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 323-357. Sponsorship: European Space Agency. refs

(Contract ESA-4726/81/F/DD/SC)

In passive remote sensing of the oceans in the visible, spectral values of radiance upwelling from the sea are estimated, and analyzed for the retrieval of phytoplankton and sediment concentrations in the surface waters. Models of radiative transfer, and the spectral characteristics of substances that determine the nature of the light emerging from the sea, are discussed here, in order to establish the link between the 'color' of the sea and concentrations of phytoplankton and suspended sediments. The inverse problem of estimating concentrations from upwelling radiance is then examined. Techniques and algorithms now in use are mostly statistical best fits. They are reviewed critically in the light of the present theoretical knowledge. Technical and practical information pertaining to satellite optical sensors available for ocean remote sensing and some airborne sensors are also given in this paper. Author

A84-43966

LAND INTO SEA DOES NOT GO

R. K. BULLARD (North East London Polytechnic, London, England) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982. Dordrecht, D. Reidel Publishing Co., 1983, p. 359-372. refs

The object of this paper is to outline the differences encountered between the recording of the three dimensional surface of the land and the three dimensional surface of the sea bed. The further detection of the 'fourth' dimension, or what the surface consists

of will also be considered, both the land and the sea bed. Most scientists using remotely sensed imagery are often unaware of the methods by which the data base to which they add their interpreted data is constructed. It is important to appreciate the relationship between the remotely sensed image and the three dimensional surface of the land or the sea bed. There are many advantages in collecting all four values (WXYZ) at the same time from the same platform. Author

A84-43968

AIRBORNE REMOTE SENSING AND EXPERIMENTS WITH FLUORESCENT TRACERS

C. VALERIO (Centre d'Etudes Techniques de l'Equipment, Les-Milles, Bouches-du-Rhone, France) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982 . Dordrecht, D. Reidel Publishing Co., 1983, p. 383-407. refs

The method of using airborne remote sensing in this type of problem on coastal pollution monitoring was described in the proceedings of the 1980 Dundee summer school on remote sensing. It is briefly recalled here and merely amplified in one or two respects. An example involving the study of the design of a new sewage outfall for the town of Antibes is described in some detail, and the consequential recommendations for the position of the new outfall are given. The use of two different fluorescent tracers, released simultaneously, to distinguish between the consequences of two different sources of pollution is also described very briefly. Author

A84-43969

OCEANOGRAPHY FROM SPACE

T. D. ALLAN (Institute of Oceanographic Sciences, Wormley, Surrey, England) IN: Remote sensing applications in marine science and technology; Proceedings of the Advanced Study Institute, Dundee, Scotland, August 1-21, 1982 . Dordrecht, D. Reidel Publishing Co., 1983, p. 409-433. refs

A description is presented of past achievements related to oceanographic measurements involving satellites. The tracking of a number of satellites provided a basis for studies in the field of geodesy, while much information concerning the oceans could be obtained in studies based on the use of satellite-tracked drifting buoys. Contributions made by satellite-borne multispectral scanners to meteorology and oceanography are also discussed. Attention is given to microwave sensors carried by the satellite Seasat, taking into account a radar altimeter, a scatterometer, a dual polarization passive radiometer, synthetic aperture radar, and an analysis of Seasat performance. Some of the scientific programs which are most likely to benefit from future satellite missions are also considered. G.R.

A84-44142

SEA SURFACE MOTION OVER AN ANTICYCLONIC EDDY ON THE OYASHIO FRONT

A. C. VASTANO (Texas A & M University, College Station, TX) and S. E. BORDERS (California, University, La Jolla, CA) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 87-90.

(Contract NSF OCE-80-26037; N00014-75-C-0537)

NOAA-6 AVHRR (11-micron band) satellite images for May 20 and 21, 1981, have been used with an interactive computer algorithm to calculate surface flow components from displacement of surface pattern features and elapsed time. The results give estimates of speed and direction for motion along the Oyashio Front and over an anticyclonic eddy between the First and Second Oyashio Intrusions. Speeds of 54 cm/s were detected along the Oyashio thermal ridge. On the periphery of the eddy, speeds in the order of 25 cm/s were present while, nearer the center, motion at 14 cm/s was indicated. A composite picture of flow vectors overlaid on the image for May 20 infers streamline flow characteristics for the surface motion and shows surface isolation of the eddy from the Tohoku area to the south. Author

A84-44539

SYNOPTIC SEA ICE - ATMOSPHERE INTERACTIONS IN THE CHUKCHI AND BEAUFORT SEAS FROM NIMBUS 5 ESMR DATA

A. M. CARLETON (Cooperative Institute for Research in Environmental Sciences, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Aug. 20, 1984, p. 7245-7258. refs

(Contract NSF DPP-79-20853)

Three case studies are used to evaluate the interactions between individual synoptic events and the sea ice cover of parts of the western Arctic in October 1976. Changes in both ice extent and concentration are assessed quantitatively by using 2-day averaged passive microwave data from the Nimbus 5 ESMR (electrically scanning microwave radiometer). These are related to daily 850-mbar resultant wind patterns for the periods considered. Strong anticyclonic conditions are associated with relatively static surface brightness temperature (T sub B) and hence with generally stable ice conditions. Conversely, a quasi-stationary cyclonic system produces marked T sub B variations involving rapid changes in ice edge position and ice concentrations. Transient atmospheric (temperature, moisture) fluctuations, associated with the passage of synoptic systems, are found not to be negligible in the interpretation of microwave sea ice T sub B signatures on short time scales. Author

A84-44588* California Univ., Santa Barbara.

OCEANOGRAPHIC BIOOPTICAL PROFILING SYSTEM

R. C. SMITH, J. L. STAR (California, University, Santa Barbara, CA), and C. R. BOOTH (Biospherical Instruments, Inc., San Diego, CA) Applied Optics (ISSN 0003-6935), vol. 23, Aug. 15, 1984, p. 2791-2797. Navy-supported research. refs

(Contract NSG-614)

A new oceanographic instrument to measure underwater optical, biological, and physical properties has been designed, built, and used extensively at sea. The new instrument system is a significant advance that permits optimum sampling strategies using ship, aircraft, and satellite optical sensors for ocean research. The design criteria for the biooptical profiling system included the rapid acquisition of data to accommodate shipboard synoptic sampling; the measurement of the necessary parameters for providing appropriate contemporaneous surface data for remote sensors; the compatibility of the data acquisition system with conventional conductivity temperature depth-type cables and winches on the oceanographic fleet; the capability of real-time display of data along with rapid preliminary data reduction at sea. The primary instrument package in this profiling system is a new microprocessor controlled multiwavelength spectroradiometer. A description of the instrument and examples of data are presented. Author

A84-44668

DRIFTING BUOY TRAJECTORIES IN THE ATLANTIC NORTH EQUATORIAL COUNTERCURRENT DURING 1983

P. L. RICHARDSON (Woods Hole Oceanographic Institution, Woods Hole, MA) Geophysical Research Letters (ISSN 0094-8276), vol. 11, Aug. 1984, p. 745-748. refs

(Contract NSF OCE-82-08744)

A84-44923* National Marine Fisheries Service, Bay Saint Louis, Miss.

ESTIMATING VEGETATION COVERAGE IN ST. JOSEPH BAY, FLORIDA WITH AN AIRBORNE MULTISPECTRAL SCANNER

K. J. SAVASTANO (NOAA, National Marine Fisheries Service, Bay Saint Louis, MS), K. H. FALLER (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Bay Saint Louis, MS), and R. L. IVERSON (Florida State University, Tallahassee, FL) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Aug. 1984, p. 1159-1170. Research supported by the U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, NASA, NSF, and NOAA. refs

A four-channel multispectral scanner (MSS) carried aboard an aircraft was used to collect data along several flight paths over St. Joseph Bay, FL. Various classifications of benthic features

were defined from the results of ground-truth observations. The classes were statistically correlated with MSS channel signal intensity using multivariate methods. Application of the classification measures to the MSS data set allowed computer construction of a detailed map of benthic features of the bay. Various densities of seagrasses, various bottom types, and algal coverage were distinguished from water of various depths. The areal vegetation coverage of St. Joseph Bay was not significantly different from the results of a survey conducted six years previously, suggesting that seagrasses are a very stable feature of the bay bottom.

Author

A84-45668* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE EFFECTS OF THE VARIATIONS IN SEA SURFACE TEMPERATURE AND ATMOSPHERIC STABILITY IN THE ESTIMATION OF AVERAGE WIND SPEED BY SEASAT-SASS

W. T. LIU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) *Journal of Physical Oceanography* (ISSN 0022-3670), vol. 14, Feb. 1984, p. 392-401. NASA-supported research. refs

The average wind speeds from the scatterometer (SASS) on the ocean observing satellite SEASAT are found to be generally higher than the average wind speeds from ship reports. In this study, two factors, sea surface temperature and atmospheric stability, are identified which affect microwave scatter and, therefore, wave development. The problem of relating satellite observations to a fictitious quantity, such as the neutral wind, that has to be derived from in situ observations with models is examined. The study also demonstrates the dependence of SASS winds on sea surface temperature at low wind speeds, possibly due to temperature-dependent factors, such as water viscosity, which affect wave development.

V.L.

A84-46145#

SATELLITE MULTICHANNEL INFRARED MEASUREMENTS OF SEA SURFACE TEMPERATURE OF THE N.E. ATLANTIC OCEAN USING AVHRR/2

D. T. LEWELLYN-JONES, P. J. MINNETT, A. M. ZAVODY (Science and Engineering Research Council, Rutherford Appleton Laboratory, Didcot, Oxon, England), and R. W. SAUNDERS (Meteorological Office, Bracknell, Berks., Science and Engineering Research Council, Rutherford Appleton Laboratory, Didcot, Oxon, England) *Royal Meteorological Society, Quarterly Journal* (ISSN 0035-9009), vol. 110, July 1984, p. 613-631. refs

It is pointed out that the measurement of sea surface temperature (s.s.t.) from space can be regarded as a particularly demanding application of atmospheric physics. Large-scale models of global air-sea heat exchange and heat transport require s.s.t. data obtained with uncertainties of less than 0.5 K. The largest source of measurement uncertainty is related to the estimation of the atmospheric correction. The possibility exists of estimating the atmospheric correction from a comparison of measured brightness temperatures in two or more wavebands, notably 3.7 and 11 microns in the case of the Advanced Very High Resolution Radiometer (AVHRR) on the Tiros-N and NOAA-6 satellites, and of 3.7, 11, and 12 microns in the case of AVHRR/2 on NOAA-7. The present investigation is concerned with results obtained from the AVHRR/2 instrument. Attention is given to atmospheric simulations, measurements of s.s.t. from NOAA-7, and a split window and triple window comparisons.

G.R.

A84-46245

THE 'PROFILES' PROGRAM OF INVESTIGATIONS OF THE INTERACTIONS BETWEEN THE ATMOSPHERE AND THE OCEAN WITH THE GOAL OF STUDYING SHORT-TERM CLIMATIC CHANGES [PROGRAMMA ISSLEDOVANIIA VZAIMODEISTVIA ATMOSFERY I OKEANA V TSELIKHI IZUCHENIIA KOROTKOPERIODNYKH IZMENENII KLIMATA /PROGRAMMA 'RAZREZY']

G. I. MARCHUK *Itogi Nauki i Tekhniki, Seriya Atmosfera, Okean, Kosmos-Programma Razrezy* (ISSN 0208-1245), vol. 1, 1983, p. 1, 3-60. In Russian. refs

The purposes, methods, and goals of a comprehensive ('Profiles') program studying the physical interactions between the atmosphere and the world oceans are described. The program consists of several separate meteorological, oceanographic, aerological, and geophysical studies of ocean/atmosphere interactions in four areas: the Northern Atlantic ocean off Norway; the Northern Atlantic ocean off Newfoundland; the Gulf-Stream zone of the Atlantic ocean off the eastern coast of the US; the tropical regions of the Atlantic Ocean near South America; and the Kuroshio polygon surrounding Japan. Data will be collected by weatherships, meteorological satellites, and aircraft-borne instruments. It is expected that the accumulated data will result in more accurate models of short-term climatic changes, due to a greater understanding of the nature of ocean/atmospheric interactive processes.

I.H.

A84-46272

REMOTE SENSING OF SEA WATER TURBIDITY WITH AN AIRBORNE LASER SYSTEM

D. M. PHILLIPS, R. H. ABBOT, and M. F. PENNY (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) *Journal of Physics D - Applied Physics* (ISSN 0022-3727), vol. 17, Aug. 14, 1984, p. 1749-1758. refs

An active remote sensing technique is discussed for independent measurement of the two intrinsic optical properties of sea water characterizing its turbidity: the absorption and scattering coefficients. The technique uses an airborne system that transmits a laser pulse down to the water and records the signal back-scattered upwards from particles in the water. The experimental results were obtained during airborne trials of the WRELADS depth sounder. Simultaneous aerial and in situ measurements of the absorption and scattering coefficients were performed. An absolute value of the absorption coefficient has been obtained by this technique without need for calibration against in situ measurements; while the determination of the scattering coefficient requires calibration of the system.

I.R.

A84-46470

SATELLITE MONITORING OF OCEAN CLIMATE [SPUTNIKOVYI MONITORING KLIMATA OKEANA]

B. A. NELEPO (Akademiia Nauk Ukrainskoi SSSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) and G. K. KOROTAEV *Meteorologiya i Gidrologiya* (ISSN 0130-2906), Aug. 1984, p. 34-41. In Russian. refs

The technical feasibility of obtaining satellite data on the large-scale variability of world ocean meteorological parameters (sea-surface temperature, near-water surface wind velocity, radiation budget, sea-water color), is considered. The distinctive features of some remote sensing methods for ocean exploration involving satellites are analyzed.

I.H.

A84-48881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CONCENTRATION GRADIENTS AND GROWTH/DECAY CHARACTERISTICS OF THE SEASONAL SEA ICE COVER

J. C. COMISO and H. J. ZWALLY (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD) *Journal of Geophysical Research* (ISSN 0148-0227), vol. 89, Sept. 20, 1984, p. 8081-8103. NASA-supported research. refs

The characteristics of sea ice cover in both hemispheres are analyzed and compared. The areal sea ice cover in the entire polar regions and in various geographical sectors is quantified for

various concentration intervals and is analyzed in a consistent manner. Radial profiles of brightness temperatures from the poles across the marginal zone are also evaluated at different transects along regular longitudinal intervals during different times of the year. These radial profiles provide statistical information about the ice concentration gradients and the rates at which the ice edge advances or retreats during a complete annual cycle. C.D.

A84-49026

SATELLITE TECHNIQUES AND THE DEVELOPMENT OF CURRENT CONCEPTS OF OCEAN DYNAMICS (SPUTNIKOVYE METODY I RAZVITIE SOVREMENNYKH PREDSTAVLENIY O DINAMIKE OKEANA)

K. N. FEDOROV (Akademiya Nauk SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 3-13. In Russian. refs

The recent literature on the application of satellite techniques to the study of physical oceanography is reviewed. Particular attention is given to the investigation of the following phenomena: the general circulation of the ocean and eddy formation and evolution; fronts and upwelling; the manifestation of internal waves on the ocean surface and their connection with the internal structure and motion of the ocean; and ocean level, wind velocity and direction over the ocean, and ice-cover characteristics. Certain problems dictated by the new satellite information concerning the ocean are also examined. B.J.

A84-49147#

RADARSAT

E. J. LANGHAM IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 246-258.

In connection with a growing interest in the exploitation of oil and gas deposits in and around the Arctic Islands, and requirements for surveillance information related to an extension of the limits of territorial waters, the possibility was considered to employ satellites for obtaining needed data. Initial studies regarding this possibility led to the start of the program Radarsat in the fall of 1980. This program is related to recommendations that a Canadian satellite carrying a synthetic aperture radar (SAR) should be launched. Developments related to the conduction of the first part of the Radarsat program are discussed, taking into account the completion of the Phase A Studies. Attention is given to the Mission Requirements Studies, international partnerships, SAR research and development, and applications development. Information to be obtained with the aid of the satellite is related to ice, oceans, renewable land resources, and geology. G.R.

A84-49161

MARINE OBSERVATION SATELLITE-1 SYSTEM AND CONTROL CONCEPTS

Y. ISHIZAWA, M. KUSANAGI (National Space Development Agency of Japan, Tokyo, Japan), T. SHIMAMURA, G. SHIRAKO, and E. NAKAGAWA (Nippon Electric Co., Ltd., Space Development Div., Yokohama, Japan) IN: Guidance and control 1984; Proceedings of the Seventh Annual Rocky Mountain Conference, Keystone, CO, February 4-8, 1984. San Diego, CA, Univelt, Inc., 1984, p. 55-73.

(AAS PAPER 84-003)

The Japanese Marine Observation Satellite MOS-1 is scheduled to be launched in the summer of 1986. This paper describes the MOS-1 hardware configuration and presents some results of the mission analysis and operational aspects. Attitude and orbital control concepts are examined along with the critical points of control subsystem design. Computer simulations and engineering test results of the control subsystem are noted to demonstrate the validity of the design. L.M.

A84-49419* Texas Univ., Austin.

TOPEX - OBSERVING THE OCEANS FROM SPACE

G. H. BORN (Texas, University, Austin, TX), C. WUNSCH (MIT, Cambridge, MA), and C. A. YAMARONE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) EOS (ISSN 0096-3941), vol. 65, July 10, 1984, p. 433, 434. Previously announced in STAR as N84-23085.

Measurement of global ocean topography by a radar altimeter aboard the TOPEX satellite is discussed. Technical aspects of satellite altimetry as they pertain to the measurement of ocean circulation are described. The TOPEX mission is explained and a general history of oceanography is included. M.A.C.

N84-29293# Massachusetts Inst. of Tech., Cambridge.

ACTIVE AND PASSIVE REMOTE SENSING OF ICE Semiannual Report, 1 Aug. 1983 - 31 Jan. 1984

J. A. KONG Apr. 1984 53 p

(Contract N00014-83-K-0258)

(AD-A141473) Avail: NTIS HC A04/MF A01 CSCL 12A

This is a report on progress that has been made in a study of active and passive remote sensing of ice. During this period the investigators (1) derived the backscattering coefficients for a two-layer anisotropic random medium; (2) calculated the emissivities from a two-layer anisotropic random medium; and (3) participated in the microwave sea ice measurement program at the Cold Regions Research and Engineering Laboratory. GRA

N84-29296# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

THE USE OF SATELLITE AND AIRCRAFT SAR TO DETECT AND CHART HAZARDS TO NAVIGATION Final Report, Aug. 1982 - Aug. 1983

E. S. KASISCHKE, R. A. SHUCHMAN, J. D. LYDEN, G. A. MEADOWS, and D. R. LYZENGA Aug. 1983 331 p

(Contract N00014-82-C-2308; N00014-76-C-1048)

(AD-A141658; ERIM-163000-2-F) Avail: NTIS HC A15/MF A01 CSCL 08C

A total survey of SEASAT and SIR-A L-band Synthetic Aperture Radar (SAR) imagery for the presence of bottom-related surface patterns was completed. Aircraft X-band SAR data collected by an APD-10 system was also reviewed. Examples from these three SAR systems are presented which further illustrate the types of bottom-related surface patterns which appear on SAR imagery. A comparison of digital SAR image intensities versus depth data demonstrates the correlation of the SAR surface patterns to bottom features, and when combined with ancillary environmental data, demonstrates the dependence of SAR surface patterns on the ambient environmental conditions. First order hydrodynamic/electromagnetic models are presented which demonstrate how bottom-related surface patterns appear on SAR images. GRA

N84-29426# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.

GEOSAT OCEAN APPLICATIONS PROGRAM (GOAP) INITIAL DATA PROCESSING AND ANALYSIS SYSTEM TEST AND EVALUATION PLAN Final Report

M. LYBANON Apr. 1984 33 p

(AD-A141673; NORDA-TN-270) Avail: NTIS HC A03/MF A01 CSCL 08C

NORDA's Remote Sensing Branch will conduct an operational demonstration as part of the GEOSAT Ocean Applications Program (GOAP). The purpose of the demonstration is to evaluate the extent to which oceanographic products can be derived from altimeter data in near real-time. This technical note describes the information processing system that will be used for this task, and plans for its development and testing. It also covers plans for the operation of the system, personnel assignments and training, evaluation of the products, and eventual transfer of the operations to FNOC or NAVOCEANO. GRA

05 OCEANOGRAPHY AND MARINE RESOURCES

N84-30148# Kansas Univ., Lawrence. Remote Sensing Lab.
NORDSEE RADAR BACKSCATTER MEASUREMENTS DATA REPORT Technical Report, 20 Jan. - 3 Feb. 1984
 S. GOGINENI, A. H. CHAUDHRY, and R. K. MOORE Mar. 1984
 46 p
 (Contract N00014-79-C-0533)
 (AD-A141914; CRINC/RSL-TR-419-2) Avail: NTIS HC A03/MF A01 CSCL 171

Radar backscatter measurements of the ocean were made by University of Kansas (KU) investigators from the Nordsee tower to determine scattering coefficients as a function of wind speed, incidence angle and look direction at C-, X- and Ku-bands and to determine the modulation of Bragg-resonant ripples by long waves. A modified version of the KU helicopter-borne scatterometer (HELOSCAT) was used to acquire the data. The radar backscatter data were collected at selected frequencies between 4 and 17 GHz, and incidence angles between 18 deg. and 70 deg. with VV- and HH-polarizations. GRA

N84-30437*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BIOLOGICAL OCEANOGRAPHY

M. R. ABBOTT *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A11-A14 Aug. 1984
 Avail: NTIS HC A04/MF A01 CSCL 08A

Within the framework of global biogeochemical cycles and ocean productivity, there are two areas that will be of particular interest to biological oceanography in the 1990s. The first is the mapping in space time of the biomass and productivity of phytoplankton in the world ocean. The second area is the coupling of biological and physical processes as it affects the distribution and growth rate of phytoplankton biomass. Certainly other areas will be of interest to biological oceanographers, but these two areas are amenable to observations from satellites. Temporal and spatial variability is a regular feature of marine ecosystems. The temporal and spatial variability of phytoplankton biomass and productivity which is ubiquitous at all time and space scales in the ocean must be characterized. Remote sensing from satellites addresses these problems with global observations of mesoscale (2 to 20 days, 10 to 200 km) features over a long period of time. B.G.

N84-30444*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OCEANIC TRANSPORT

R. CHASE and L. MCGOLDRICK *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A34-A36 Aug. 1984
 Avail: NTIS HC A04/MF A01 CSCL 08C

The importance of large-scale ocean movements to the moderation of Global Temperature is discussed. The observational requirements of physical oceanography are discussed. Satellite-based oceanographic observing systems are seen as central to oceanography in 1990's. R.J.F.

N84-30445*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

POLAR GLACIOLOGY

G. D. ROBIN *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A37-A40 Aug. 1984
 Avail: NTIS HC A04/MF A01 CSCL 08L

Two fields of research on polar ice sheets are likely to be of dominant interest during the 1990s. These are: the role of polar ice sheets in the hydrological cycle - ocean-atmosphere-ice sheets-oceans, especially in relation to climate change; and the study and interpretation of material in deep ice cores to provide improved knowledge of past climates and of the varying levels of atmospheric constituents such as CO₂, NO_x, SO₂, aerosols, etc., over the past 200,000 years. Both topics require a better knowledge of ice dynamics. Many of the studies that should be undertaken in polar regions by Earth Observing System require similar instruments and techniques to those used elsewhere over oceans and inland surfaces. However to study polar regions two special

requirements need to be met: Earth Observing System satellite(s) need to be in a sufficiently high inclination orbit to cover most of the polar regions. Instruments must also be adapted, often by relatively limited changes, to give satisfactory data over polar ice. The observational requirements for polar ice sheets in the 1990s are summarized. R.J.F.

N84-30446*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SEA ICE

S. F. ACKLEY *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A41-A43 Aug. 1984
 Avail: NTIS HC A04/MF A01 CSCL 08L

Scientific objectives and observational requirements relative to sea ice studies in the 1990's are discussed. The development of coupled ice-ocean-atmosphere models that provide information comparable to real data sets through interactive processes is discussed. A series of particular problems that would provide the basis for such a verification data set and which is amenable to satellite systems available or realizable over the next 20 years is presented. R.J.F.

N84-30469*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OCEAN CIRCULATION STUDIES

C. J. KOBLINSKY *In its* Res. Activities of the Geodyn. Branch 4 p Jun. 1984 refs
 Avail: NTIS HC A06/MF A01 CSCL 08C

Remotely sensed signatures of ocean surface characteristics from active and passive satellite-borne radiometers in conjunction with in situ data were utilized to examine the large scale, low frequency circulation of the world's oceans. Studies of the California Current, the Gulf of California, and the Kuroshio Extension Current in the western North Pacific were reviewed briefly. The importance of satellite oceanographic tools was emphasized. R.S.F.

N84-30470*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GLOBAL MEAN SEA SURFACE BASED UPON SEASAT ALTIMETER DATA

J. G. MARSH *In its* Res. Activities of the Geodyn. Branch 6 p Jun. 1984 refs
 Avail: NTIS HC A06/MF A01 CSCL 08J

A global mean sea surface based upon the SEASAT altimeter data was derived. A combination of crossing arc techniques, accurate SEASAT reference orbits, and a previously computed GOES-3/SEASAT mean sea surface were used in the computation process. This mean sea surface provides a basis for the determination of global ocean circulation patterns and for detailed analysis of the Earth's internal structure. A contour map of the global mean sea surface is presented. Author

N84-30471*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN OBJECTIVE ANALYSIS TECHNIQUE FOR EXTRAPOLATING TIDAL FIELDS

B. V. SANCHEZ *In its* Res. Activities of the Geodyn. Branch 8 p Jun. 1984 refs
 Avail: NTIS HC A06/MF A01 CSCL 08C

An interpolation technique which allows accurate extrapolation of tidal height fields in the ocean basins by making use of selected satellite altimetry measurements and/or conventional gauge measurements was developed and tested. A normal mode solution for the Atlantic and Indian Oceans was obtained by means of a finite difference grid. Normal mode amplitude maps are presented. R.S.F.

N84-30494# Joint Publications Research Service, Arlington, Va.
INTERPRETING SPECTRA OF SEA SURFACE AERIAL PHOTOGRAPHS Abstract only

A. G. LUCHININ *In its USSR Rept.:* Earth Sci. (JPRS-UES-84-006) p 73 13 Aug. 1984 refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR: Fiz. Atmosfery i Okeana (Moscow), v. 20, no. 3, Mar. 1984 p 331-334

Avail: NTIS HC A05/MF A01

The image of the sea surface formed in the visible spectral range includes information on surface waves; the spatial spectrum of aerial photographs of the surface corresponds to the spectrum of wave slopes. Modulation of brightness of the sea surface by waves can be caused by different physical factors. The influence of angular nonuniformity of sea surface illumination and the dual focusing phenomenon arising with the double transmission of light through the wave-covered air-water interface was studied. It is shown that the contribution of the dual focusing effect is important in an extremely wide range of spatial scales. It is possible to characterize the spectral dependence of the relative contribution of the dual focusing effect to the formation of brightness fluctuations more completely by introducing the parameter $a^* = \max a(k)$ and the spatial frequency k^* showing at what spatial scales a maximum of the function $a(k)$ is formed. These parameters are computed as a function of optical wavelength. The contribution of the dual focusing effect is most conspicuous in the region of wavelengths λ approximately 500 nm. This effect exerts an influence not only in the magnitude of the fluctuations, but also on their angular spectrum. Author

N84-30598# Airborne Research Associates, Weston, Mass.
METEOROLOGICAL RESEARCH AND SUPPORT FOR THE MIZEX (MARGINAL ICE ZONE EXPERIMENT) PROGRAM Final Report

R. MARKSON 4 Apr. 1984 71 p

(Contract N00014-83-C-0088)

(AD-A142409) Avail: NTIS HC A04/MF A01 CSDL 04B

This report will discuss the measurements and ice photography obtained from the Beechcraft Baron atmospheric research aircraft operated by Airborne Research Associates (ARA) during the 1983 Marginal Ice Zone Experiment (MIZEX-83). The aircraft was instrumented to measure the bulk meteorological parameters, turbulence, surface fluxes (inferred), sea surface temperature, the atmospheric electric field and conductivity. In addition, photography was obtained including the only photomosaic in MIZEX-83 and several transects which were made in color. Eleven flights were conducted from the Longyearbyen airport; one was for the mosaic and the others were for meteorology. The flight program was successful both in obtaining a 40 km x 40 km photomosaic of the region studied by the remote sensing aircraft on 11 July and in obtaining good quality meteorological data almost all the time. All flights were accomplished despite the fog, low ceilings and minimal visibility because it was possible to operate just above the ice/ocean surface. The meteorological measurements were mostly concerned with the evolution of the planetary boundary layer under conditions of on-ice and off-ice winds. Measurements were made using horizontal and vertical profile flight patterns. GRA

N84-30633# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

SUMMARY OF SAR (SYNTHETIC APERTURE RADAR) OCEAN WAVE DATA ARCHIVED AT ERIM (ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN) Topic Report, Oct. 1982 - Apr. 1984

J. D. LYDEN May 1984 122 p

(Contract N00014-81-C-0692)

(AD-A142620; ERIM-155900-17-T) Avail: NTIS HC A06/MF A01 CSDL 20D

Synthetic aperture radar (SAR) ocean wave imagery processed, analyzed, and archived at the Environmental Research Institute of Michigan (ERIM) is summarized. This summary includes a review of the SAR systems used to collect ocean wave imagery, as well as a brief review of the experiments where SAR ocean wave data was collected. The imagery from these experiments was

manually examined to qualitatively rate the detectability of waves in each pass. This information is summarized in table form, along with the SAR operating parameters and environmental conditions for each of the experiments. The data summarized in this report can be used in evaluating current and future SAR ocean wave imaging models. GRA

N84-31873# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.

LARGE-SCALE ATMOSPHERE-OCEAN COUPLING Final Technical Report, May 1980 - Apr. 1983

C. P. CHANG and K. M. LAU May 1984 101 p

(Contract NSF ATM-79-24010)

(AD-A143162; NPS63-84-004) Avail: NTIS HC A06/MF A01 CSDL 04B

Large-scale coupling between the tropical atmosphere and ocean in relation to the El Nino/Southern Oscillation (ENSO) phenomenon is studied using both observational and theoretical/modeling approaches. Utilizing satellite observations, a connection has been successfully identified between Pacific tropical diabatic heating anomalies and extratropical circulation system over the North Pacific from East Asia to the continental North America. This teleconnection is strongly correlated with tropical Pacific sea surface temperature anomalies during ENSO. Shorter period fluctuation (40-50 day period) in the atmosphere also shows some signature of the above teleconnection pattern suggesting the presence of a multi-equilibrium climate state realizable both in the intraseasonal and interannual time scale. The above observations have led to the development of a stochastic-dynamical theory of ENSO, now being pursued by one of the Co-PI's (KML). Based on the results of an earlier theoretical investigation showing the presence of unstable coupled air-sea interaction in the tropics, a coupled atmosphere-ocean model has been developed. Various versions of this model and parameterization of air-sea coupling have been tested, and experiments performed. B.W.

N84-31899# Science Applications, Inc., Raleigh, N.C.
SOUTH ATLANTIC PHYSICAL OCEANOGRAPHY STUDY (YEAR 5). VOLUME 1: EXECUTIVE SUMMARY Final Report

L. ATKINSON, O. BROWN, T. CURTIN, P. HAMILTON, T. LEE, L. PIETRAFESS, and E. WADDELL Feb. 1984 19 p

(Contract DI-14-12-0001-29201)

(PB84-187855; MMS/AT/ES-84/13) Avail: NTIS HC A02/MF A01 CSDL 08J

Between 1977 and 1984 a physical oceanographic field measurement and data interpretation and synthesis program was conducted for an area extending alongshore from approximately Cape Hatteras to Cape Canaveral and offshore cross the shelf and the Blake Plateau. Emphasis was on shelf and shelf-break processes. Primary measurements made or used extensively in one or more program years include: subsurface currents/temperature, regional/seasonal hydrography, satellite thermal imagery, coastal water levels, and coastal and marine winds. Conditions on the shelf in the Georgia embayment are emphasized. Results describe Gulf Stream impacts on regional or process specific circulation patterns, e.g., Gulf Stream meanders and boundary eddies or filaments. The response of shelf currents and water level to tidal and wind stress forcing mechanisms are also described. GRA

N84-31900# National Environmental Satellite Service, Washington, D. C.

MONITORING OF LONG WAVES IN THE EASTERN EQUATORIAL PACIFIC 1981-1983 USING SATELLITE MULTI-CHANNEL SEA SURFACE TEMPERATURE CHARTS

R. LEHECKIS and W. PICHEL Apr. 1984 142 p refs

(PB84-190487; EPOCS/CONTRIB-841; NOAA-TR-NESDIS-8;

NOAA-84050701) Avail: NTIS HC A07/MF A01 CSDL 08J

The contents include: multi-channel sea surface temperature (MCSST) procedure; summary of 1981 to 1983 satellite observations; MCSST contour charts in the Eastern Equatorial Pacific; equatorial long waves in the MCSST analysis; MCSST

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time series in the Eastern Equatorial Pacific; and noise in NOAA-7 AVHRR channel 3. GRA

N84-32896*# Colorado Univ., Boulder. Cooperative Inst. for Research in Environmental Sciences.

PILOT STUDY AND EVALUATION OF A SMMR-DERIVED SEA ICE DATA BASE Final Report

R. G. BARRY, M. R. ANDERSON, R. G. CRANE, V. J. TROISI, and R. L. WEAVER 30 Jun. 1984 48 p refs

(Contract NAGW-363; NSF DPP-81-7265)

(NASA-CR-175255; NAS 1.26:175255) Avail: NTIS HC A03/MF A01 CSDL 08L

Data derived from the Nimbus 7 scanning multichannel microwave radiometer (SMMR) are discussed and the types of problems users have with satellite data are documented. The development of software for assessing the SMMR data is mentioned. Two case studies were conducted to verify the SMMR-derived sea ice concentrations and multi-year ice fractions. The results of a survey of potential users of SMMR data are presented, along with SMMR-derived sea ice concentration and multiyear ice fraction maps. The interaction of the Arctic atmosphere with the ice was studied using the Nimbus 7 SMMR. In addition, the characteristics of ice in the Arctic ocean were determined from SMMR data. R.S.F.

N84-32982# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ASPECTS OF THE BRAZIL CURRENT SYSTEM ACCORDING TO SMS-2, NOAA-6, AND TIROS-N SATELLITES FOR 1979 TO 1980 [ASPECTOS DO SISTEMA DA CORRENTE DO BRASIL SEGUNDO OS SATELITES SMS-2, NOAA-6 E TIROS-N, NOS ANOS 1979 E 1980]

H. M. I. VILLAGRA and M. R. STEVENSON Dec. 1983 74 p In PORTUGUESE; ENGLISH summary

(INPE-2975-RPE/450) Avail: NTIS HC A04/MF A01

The Brazil Current System was studied systematically in INPE from 1974 by utilizing THIR data of NIMBUS 5 and oceanographic data. With the regular reception of thermal and visible data from SMS-2, NOAA-6 and TIROS-N satellites it was possible to study this Current System with greater detail. Images of these satellites were interpreted by using the Image-100 System available in INPE. A more detailed and accurate description of the Current System was obtained for 1979 and 1980. The comparison of satellite data with conventional oceanographic data has given reasonably good results in the limits of the precision of the satellites systems utilized. Author

N84-32984# Naval Research Lab., Washington, D. C. **DETERMINATION OF SEA SURFACE TEMPERATURE WITH N-ROSS (NAVY-REMOTE OCEAN SENSING SYSTEM) Final Report**

J. P. HOLLINGER and R. C. LO 16 Jul. 1984 63 p (AD-A143563; NRL-MR-5375) Avail: NTIS HC A04/MF A01 CSDL 08J

The all-weather, global determination of sea surface temperature (SST) was identified as a requirement needed to support Navy operations. The acceptable SST accuracy is \pm or 1.0 K with a surface resolution of 25 km. Investigations of the phenomenology and technology of remote passive microwave sensing of the ocean environment over the past decade beginning with the Navy specification of the Remote Ocean-surface Measurement System, through the NASA launched Scanning Multichannel Microwave Radiometer flown on both SEASAT and NIMBUS-7 to the planning by NASA of the Large Antenna Multichannel Microwave Radiometer, and development of the Mission Sensor Microwave/Imager (SSM/I) to be flown in 1985 by the Navy/Air Force, have demonstrated that this objective is presently attainable. Preliminary specifications and trade-off studies have been conducted to define the frequency, polarization, scan geometry, antenna size and other essential parameters, as well as the retrieval algorithms and spacecraft interface requirements, of the Low Frequency Microwave Radiometer (LFMR). As presently planned, the LFMR will be a stand alone system completely

independent of the SSM/I but with a 30 rpm conical scan at 53.1 deg incidence angle identical to the SSM/I. It will be a dual-frequency system at 5.2 and 10.4 GHz using a 5.9 meter deployable mesh surface antenna. It is to be flown on the Navy-Remote Ocean Sensing System satellite scheduled to be launched in late 1988. Author (GRA)

N84-32986*# National Academy of Sciences - National Research Council, Washington, D. C. Ocean Climate Research Committee.

GLOBAL OBSERVATIONS AND UNDERSTANDING OF THE GENERAL CIRCULATION OF THE OCEANS Final Report

Mar. 1984 425 p refs Proc. of Workshop, Woods Hole, Mass., 8-12 Aug. 1983 Sponsored in part by NOAA

(Contract NSF OCE-83-11753/R)

(NASA-CR-173905; NAS 1.26:173905; PB84-195411) Avail:

NTIS HC A18/MF A01 CSDL 08C

The workshop was organized to: (1) assess the ability to obtain ocean data on a global scale that could profoundly change our understanding of the circulation; (2) identify the primary and secondary elements needed to conduct a World Ocean Circulation Experiment (WOCE); (3) if the ability is achievable, to determine what the U.S. role in such an experiment should be; and (4) outline the steps necessary to assure that an appropriate program is conducted. The consensus of the workshop was that a World Ocean Circulation Experiment appears feasible, worthwhile, and timely. Participants did agree that such a program should have the overall goal of understanding the general circulation of the global ocean well enough to be able to predict ocean response and feedback to long-term changes in the atmosphere. The overall goal, specific objectives, and recommendations for next steps in planning such an experiment are included. GRA

N84-33869# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

A SAR FOR REAL-TIME ICE RECONNAISSANCE

A. NICHOLS, T. GAFFIELD, J. WILHELM, R. INKSTER (Intera Environmental Consultants Ltd., Calgary, Alberta), and S. LEUNG (Intera Environmental Consultants Ltd., Calgary, Alberta) In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 71-76 Aug. 1984

Avail: NTIS HC A24/MF A01

A small lightweight SAR for ice monitoring was built to support engineering operations for oil exploration in the Arctic. The SAR is a fully-focused sidelooking system capable of mapping either side of the aircraft. It has two modes, Wide Swath, which covers 45 km, and High Resolution, which covers 22 km. Azimuth resolution is 6 m for both modes, with range resolution 12 m in the Wide Swath and 6 m in the High Resolution mode. The instrument is installed in a Cessna 441 Conquest capable of flying at high altitudes with minimum fuel consumption. An image is produced in real time by a digital image formation processing system aboard the aircraft. This image is transmitted to a ground station via a data link where a hardcopy is formed on heat-developed film. Author (ESA)

N84-33905# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

THE INFORMATION CONTENT OF SPACEBORNE SAR OCEAN IMAGE SPECTRA

T. W. GERLING, R. C. BEAL, and D. G. TILLEY In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 307-314 Aug. 1984 refs Original contains color illustrations

Avail: NTIS HC A24/MF A01

The signatures of wave systems and the wind field in digitally processed SEASAT SAR imagery and spectra are discussed. Results indicating evidence of waves in the several hundred meter range of spectra properly corrected for various contaminating effects are reviewed. Wind field signatures are found in the several kilometer scale spectral range, and are typically manifested through higher correlation downwind. The resulting spectral asymmetry is used to estimate wind directions from SEASAT Pass 1339 SAR spectra which are compared with other measurements. Roll vortices

are discussed as a basis for this signature, and spectral processing techniques used to enhance the often subtle and noisy signatures are considered.

Author (ESA)

N84-33907# Ministry of Posts and Telecommunications, Tokyo (Japan). Radio Research Labs.

MEASUREMENTS OF MICROWAVE BACKSCATTERING SIGNATURES OF THE OCEAN SURFACE USING X-BAND AND KA-BAND AIRBORNE SCATTEROMETER/RADIOMETER SYSTEM

H. MASUKO, K. KAMOTO, S. YOSHIKADO, T. TAKASUGI, M. SHIMADA (National Space Development Agency, Ibaraki, Japan), H. YAMADA (National Space Development Agency, Ibaraki, Japan), and S. NIWA (National Space Development Agency, Ibaraki, Japan) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 321-326 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

An airborne microwave scatterometer/radiometer system operated at X-band (3 cm) and Ka-band (8.7 mm) was applied to the observations of microwave scattering signatures of the ocean. The differential backscattering cross sections were measured as combined functions of frequency (10.00 GHz and 34.43 GHz), polarization (HH and VV), wind speed (3.2 to 17.2 m/sec), azimuth angle (0 to 360 deg), and incident angle (0 to 70 deg). The azimuthal anisotropic features for Ka-band are similar to those for X-band, and the wind speed dependence is analyzed for each azimuth angle, polarization, and incident angle. For each parameter, behavior of the backscattering cross section for microwave frequencies are compared with previous results. The relations of the microwave scattering signatures and ocean wave spectrum are discussed.

Author (ESA)

N84-33908# Johns Hopkins Univ., Laurel, Md. Applied Physics Lab.

COMPARISON OF OCEAN WAVE ENERGY MEASURED BY SEASAT SYNTHETIC APERTURE RADAR WITH SAR SURFACE WAVE IMAGING THEORIES

F. M. MONALDO and R. C. BEAL *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 327-332 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

Correlation between the dominant wavelength and propagation direction of the SAR image spectrum and the actual ocean surface dominant wavelength and direction is discussed. The relationship between the SAR image spectrum energy and the mean square ocean wave-height or wave-slope spectrum is considered. The correlation of SAR image spectral energy with independent measurements of the ocean surface spectrum for SEASAT pass 1339 off the east coast of the United States suggests at least a systematic relationship between the two.

Author (ESA)

N84-33909# Sofia Univ. (Bulgaria). Inst. of Electronics.
REMOVAL OF AMBIGUITY OF TWO-DIMENSIONAL GRAY LEVEL VARIANCE SPECTRA OBTAINED BY PROCESSING SHIP RADAR IMAGES OF OCEAN WAVES

V. ATANASSOV, W. ROSENTHAL (Max-Planck Institut fuer Meteorologie, Hamburg), and E. ZIEMER (Deutsches Hydrographisches Inst.) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 333-336 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

An analysis that generates nonsymmetric waves spectra from two successive radar images providing a unique wave direction for each spectral component is presented. The method resolves the 180 deg ambiguity in conventional spatial Fourier transform derived from a frozen sea surface. The technique may substitute three-dimensional Fourier analysis of sequential wave images especially where only a limited number of images from the same area can be taken in sequence, e.g., in cases of an airborne or spaceborne radar.

Author (ESA)

N84-33910*# National Aeronautics and Space Administration, Washington, D. C.

REMOTE SENSING OF THE MARGINAL ICE ZONE DURING MARGINAL ICE ZONE EXPERIMENT (MIZEX) 83

R. A. SHUCHMAN (ERIM), W. J. CAMPBELL (USGS), B. A. BURNS (ERIM), E. ELLINGSEN (MTNFR), B. A. FARRELLY (Bergen Univ.), P. GLOERSEN, T. C. GRENFELL (Washington Univ.), J. HOLLINGER (NRL), D. HORN (ONR), J. A. JOHANNESSEN (Bergen Univ.) et al. *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 339-346 Aug. 1984 refs

(Contract N00014-83-C-0404; N00014-82-C-0063)

Avail: NTIS HC A24/MF A01

The remote sensing techniques utilized in the Marginal Ice Zone Experiment (MIZEX) to study the physical characteristics and geophysical processes of the Fram Strait Region of the Greenland Sea are described. The studies, which utilized satellites, aircraft, helicopters, and ship and ground-based remote sensors, focused on the use of microwave remote sensors. Results indicate that remote sensors can provide marginal ice zone characteristics which include ice edge and ice boundary locations, ice types and concentration, ice deformation, ice kinematics, gravity waves and swell (in the water and the ice), location of internal wave fields, location of eddies and current boundaries, surface currents and sea surface winds.

Author (ESA)

N84-33912# Naval Research Lab., Washington, D. C.

MILLIMETER WAVE RADIOMETRIC IMAGES OF THE MARGINAL ICE ZONE

J. P. HOLLINGER, M. R. KELLER (Computer Sciences Corp., Silver Spring, Md.), C. A. LUTHER (ONR, Arlington, Vir.), and R. O. RAMSEIER (Department of the Environment, Ottawa) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 353-358 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

Airborne radiometric imaging measurements at 90, 135, and 216 GHz over the marginal ice zone in the Greenland Sea were obtained in July. A 130 by 130 km area was mapped at 90 GHz from 7.6 km. High resolution images were obtained from 900m at 90 and 140 GHz of selected regions. The large area images provide information on ice type, motion, and concentration. The low altitude imagery provides details of ice structure. Emissivities of summer ice differ from typical winter values because of wet snow cover. Ice concentrations calculated from satellite and aircraft data agree except at the edge, because of the large satellite footprint.

Author (ESA)

N84-33913# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

ACTIVE MICROWAVE MEASUREMENTS OF SEA ICE IN THE MARGINAL ICE UNDER SUMMER CONDITIONS

R. G. ONSTOTT and R. K. MOORE *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 359-363 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Radar backscatter from sea ice during summer melt in the marginal ice zone between East Greenland and Spitzbergen was measured. Data were acquired using a ship-based and helicopter-borne scatterometer at frequencies between 4 and 18 GHz, at angles from 10 deg to 83 deg from vertical, and with like- and cross-antenna polarizations. Sensor-oriented ice characterization measurements were also made. Scattering coefficients of the major ice types in the region were obtained. The influence of summer melt on ice conditions and the radar response was studied. There were three major ice types: first-year, thick first-year, and multiyear. Thick ice often shows significant deformation. Ice features covered by snow are masked and exhibit low backscatter, while those with or without firm produce higher backscatter.

Author (ESA)

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N84-33914# Bergen Univ. (Norway). Inst. of Geophysics.
EDDY STUDIES DURING MARGINAL ICE ZONE EXPERIMENT (MIZEX) 83 BY SHIP AND REMOTE SENSING OBSERVATIONS
O. M. JOHANNESSEN, J. A. JOHANNESSEN, B. A. FARRELLY, K. KLOSTER (Chr. Michelsens Inst., Bergen), and R. H. SCHUCHMAN (Environmental Research Inst. of Michigan, Ann Arbor) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 365-368 Aug. 1984 refs
Sponsored by Office of Naval Research, Royal Norwegian Council for Scientific and Industrial Research and Norwegian Research Council for Science and the Humanities Original contains color illustrations

Avail: NTIS HC A24/MF A01

Synoptic studies were carried out of the ocean-ice eddy located over a deep bathymetric depression, the Molloy Deep centered at 79 deg 08'N and 3 deg E. This eddy was studied using conventional and helicopter conductivity/temperature/depth stations, XBT's and towed sensors from ships, SAR and passive microwave observations from two remote sensing aircraft, visual and IR images from NOAA satellites, AXBT's from a third aircraft and ARGOS drifting buoys located on ice floes with current meters below. The observations indicated that this eddy with a scale of 60 km is topographically generated and possibly trapped by the bathymetric depression extending down to more than 5000m depth. Smaller eddies of 10 to 20 km length scale are generated around the boundary of the larger one. Author (ESA)

N84-33915# Chr. Michelsen Inst., Bergen (Norway).
MAPPING THE FRAM STRAIT ICE EDGE USING AVHRR IMAGERY AND NOAA SATELLITE ORBITAL DATA
K. KLOSTER and B. A. FARRELLY (Bergen Univ.) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 369-372 Aug. 1984 refs
Avail: NTIS HC A24/MF A01

About 30 images from the NOAA-7 and NOAA-8 satellite AVHRR instruments from the Fram Strait in June and July were used to map ice albedo and sea surface temperature. The geographical gridding procedure used to produce overlay grids is described. The procedure is based on knowledge of satellite orbital data combined with accurate time for the scan lines. The resulting grid accuracy is good on scan-line direction, but serious errors occur in the nadir-line direction. Accurate maps of Svalbard and Greenland coastlines are used for corrections. An example of ice trajectory mapping is described. Author (ESA)

N84-33916*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Goddard Lab. for Atmospheric Sciences.
OBSERVATION OF VARIATIONS IN THE COMPOSITION OF SEA ICE IN THE GREENLAND MIZ DURING EARLY SUMMER 1983 WITH THE NIMBUS-7 SMMR
P. GLOERSEN and W. J. CAMPBELL (Puget Sound Univ., Tacoma) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 373-378 Aug. 1984 refs
Sponsored by ONR
Avail: NTIS HC A24/MF A01 CSCL 08M

Data acquired with the Scanning Multichannel Microwave Radiometer (SMMR) on board the Nimbus-7 Satellite for a six-week period in Fram Strait were analyzed with a procedure for calculating sea ice concentration, multiyear fraction, and ice temperature. Calculations were compared with independent observations made on the surface and from aircraft to check the validity of the calculations based on SMMR data. The calculation of multiyear fraction, which was known to be invalid near the melting point of sea ice, is discussed. The indication of multiyear ice is found to disappear a number of times, presumably corresponding to freeze/thaw cycles which occurred in this time period. Author (ESA)

N84-33917*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE CHARACTERISTICS OF THE BERING SEA ICE COVER DURING MARGINAL ICE ZONE EXPERIMENT (MIZEX) WEST
D. J. CAVALIERI, P. GLOERSEN, T. T. WILHEIT, and C. CALHOON *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 379-384 Aug. 1984 refs
Avail: NTIS HC A24/MF A01 CSCL 08M

Passive microwave measurements of the Bering Sea were made with the NASA CV-990 airborne laboratory during February. Microwave data were obtained with imaging and dual-polarized, fixed-beam radiometers in a range of frequencies from 10 to 183 GHz. The high resolution imagery at 92 GHz provides a particularly good description of the marginal ice zone delineating regions of open water, ice compactness, and ice-edge structure. Analysis of the fixed-beam data shows that spectral differences increase with a decrease in ice thickness. Polarization at 18 and 37 GHz distinguishes among new, young, and first-year sea ice types. Author (ESA)

N84-33918# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
SURFACE BASED BRIGHTNESS TEMPERATURES OF SEA ICE IN THE BERING AND GREENLAND SEAS
T. C. GRENFELL *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 385-389 Aug. 1984 refs
Avail: NTIS HC A24/MF A01

Brightness temperatures of sea ice was measured during the Marginal Ice Zone Experiment (MIZEX) field experiments in February in the Bering Sea and in June/July in the northern Greenland Sea. In the Bering Sea thin growing sea ice types from black ice to 40 cm thick snow covered floes were investigated. Brightness temperatures increase with ice thickness up to 10 cm from values of 100 K for open water to as high as 250 K ($\epsilon = 0.97$) for thick ice, and a moderate dependence on snow thickness is found. In the Greenland Sea thick first and multiyear (FY, MY) ice types were studied. Brightness temperatures vary, depending on the daily melt-freeze cycle superimposed on the seasonal warming, ranging from near blackbody values for melting conditions to multiyear-like spectra when the surface layers refroze. The melt season was sufficiently advanced, however, that FY and MY ice could not be differentiated radiometrically. Author (ESA)

N84-33919# Bergen Univ. (Norway). Inst. of Geophysics.
SEASONAL ICE VARIATION IN THE BARENTS SEA OBTAINED FROM THE NIMBUS 7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) OBSERVATIONS
T. OLAUSSEN, O. M. JOHANNESSEN, and E. SVENDSEN *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 391-393 Aug. 1984 refs
Sponsored by Norwegian Committee for Industrial and Scientific Research and ONR
Avail: NTIS HC A24/MF A01

The seasonal ice variation in the Barents Sea for 1978/1979 was derived using the NORSEX sea ice algorithm on Nimbus 7 Scanning Multichannel Microwave Radiometer observations. Case studies of the ice edge variation and ice concentration are studied in relation to atmospheric and oceanic conditions. Concentration plots show that there is virtually no multiyear ice present in the Barents Sea throughout the year. Quite often, unaccountably large negative multiyear values show up. These are believed to be caused by a very thin layer of newly formed ice, a situation not taken into account in the algorithm, thus underestimating the total ice concentration and overestimating the first year ice concentration. However, these may enable a distinction between ice edge advance due to new ice formation and ice edge advance due to wind-forcing to be made. Author (ESA)

N84-33920# Bergen Univ. (Norway). Inst. of Geophysics.
THE DISTRIBUTION OF ICE CONCENTRATION, MULTIYEAR AND FIRST YEAR FRACTION IN THE ARCTIC OCEAN DERIVED FROM THE NIMBUS 7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) OBSERVATIONS

E. SVENDSEN, O. M. JOHANNESSEN, and T. OLAUSSEN /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 395-397 Aug. 1984 refs Sponsored by Norwegian Committee for Industrial and Scientific Research and ONR

Avail: NTIS HC A24/MF A01

Based on the NORSEX ice algorithms for retrieving total ice concentration, multiyear, and first year fraction from the Nimbus 7 Scanning Multichannel Microwave Radiometers, ice maps are produced through an annual cycle. Features of the ice edge are discussed. The algorithm works well in all parts of the Arctic when the ice surface is dry. During the summer melt season, the amount of multiyear ice cannot be estimated due to the wet snow on the ice. However, the total ice concentration estimates seem reasonable also for this season, except when large amounts of melt ponds exist. These melt ponds are estimated as open water.

Author (ESA)

N84-33921# Bergen Univ. (Norway). Dept. of Oceanography,
EVALUATION OF WIND ESTIMATES OVER OPEN OCEAN FROM THE NIMBUS 7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER

E. SVENDSEN /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 399-402 Aug. 1984 refs Sponsored by Norwegian Meteorological Institute

Avail: NTIS HC A24/MF A01

The polarization ratio (PR) defined as the difference divided by the sum of vertical and horizontal polarized brightness temperatures measured from the Nimbus 7 Scanning Multichannel Microwave Radiometers at 17.7 GHz and ship measured winds (W) are used to derive a linear algorithm for wind retrievals: $W = 104.5 - 411.5 \cdot PR$ 10.7 m/sec. Theoretical studies of PR indicate that variations in sea surface temperature have negligible effects on the retrievals. The empirical results give a standard error of estimate of 2 m/sec. The theory, however, shows that variation in the atmosphere should cause greater variations than 2 m/sec, which indicated that atmospheric and wind effects on PR are correlated.

Author (ESA)

N84-33922*# Centre National d'Etudes Spatiales, Toulouse (France).

COMPARISON OF SEA SURFACE WIND SPEED FIELDS BY SEASAT RADAR ALTIMETER, SCATTEROMETER AND SCANNING MULTICHANNEL MICROWAVE RADIOMETER WITH AN EMPHASIS ON THE SOUTHERN OCEAN

N. M. MOGNARD and W. J. CAMPBELL (Puget Sound Univ., Tacoma) /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 403-409 Aug. 1984 refs Sponsored by NASA Goddard Space Flight Center and ESA

Avail: NTIS HC A24/MF A01

The SEASAT altimeter (ALT), scatterometer (SASS), and scanning microwave multichannel radiometer (SMMR) measured sea surface wind speed. During the satellite lifetime from June to October 1978, the Austral winter, the highest wind speeds were recorded in the Southern Ocean. Three-month, monthly, and three-day surface wind speed fields deduced from the three Seasat wind speed sensors are compared. The monthly and three-day fields show a pronounced mesoscale (1000 km) variability in wind speed. At all space and time scales analyzed, differences of 40% are found in the magnitude of the wind speed features, with the ALT consistently yielding the lowest wind speed and the SMMR the highest.

Author (ESA)

N84-33943# Bonn Univ. (West Germany). Inst. fuer Theoretische Geodäsie.

GEOPHYSICAL USE OF THE DATA OF THE ERS-1 ALTIMETER

K. R. KOCH /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 545-547 Aug. 1984 refs Avail: NTIS HC A24/MF A01

The use of orbit computations to transform ERS-1 altimetric data to surface heights of the oceans and of the ice of the polar regions referred to a known reference surface, approximating mean sea level is proposed. For oceanography and geophysics the sea surface heights need to be separated into heights of the geoid and sea surface heights referred to the geoid, which can be accomplished by frequency analysis and filtering. The accuracy of the geoid thus determined depends on the accuracy of the orbit computation of ERS-1. But even if this accuracy is inferior to the accuracy of the altimetric measurements, the determination of the sea surface heights with respect to the geoid is feasible in local ocean areas because of the repetitivity of the ground tracks of ERS-1.

Author (ESA)

N84-33945# Manitoba Univ., Winnipeg. Dept. of Earth Sciences.

ON THE HYDRODYNAMIC CORRECTIONS OF SEASAT-ALT DATA AND GEODYNAMIC APPLICATION

W. MOON and R. IANG /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 553-557 Aug. 1984 refs

(Contract NRC-A-7400)

Avail: NTIS HC A24/MF A01

An interactive hydrodynamic modelling scheme to study the transient sea surface height variations over the Hudson Bay area of Canada is investigated. Deriving estimates of meteorological forces over sea surface from limited atmospheric information are discussed. An input subroutine of a finite difference type algorithm is developed for surface wind fields. Ocean bottom friction mechanisms (linear and quadratic) are reviewed in regard to the algorithms. By combining the wind speed prediction algorithm with the interactive hydrodynamic modelling scheme, the transient sea surface corrections due to the atmospheric disturbances can be made. Results indicate that the wind speed predicted by the MSL pressure charts appears to be smaller than the SEASAT-GDR file inferred values.

Author (ESA)

N84-33956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SASS 1 MODEL FUNCTION EVALUATION AND UPGRADE

C. L. BRITT (Research Triangle Inst., Research Triangle Park, N.C.) and L. C. SCHROEDER /in ESA IGARSS 84: Remote Sensing: From Res. towards Operational Use, Vol. 2 p 623-629 Aug. 1984 refs

(Contract NAS1-15338)

Avail: NTIS HC A15/MF A01 CSCL 14B

A large data base of Seasat A Satellite Scatterometer (SASS) measurements merged with high-quality surface truth wind data was developed by determining the times when SASS measurements were taken in the vicinity of selected in situ measurement sites. Good data obtained from 37 sites located in the coastal waters of North America, Australia, Western Europe and Japan were assembled by correlating the SASS and surface truth measurements in time and space. These data were analyzed to independently determine the model function suggested for inversion of SASS data to winds. Wind inversion errors of the model function are examined and compared with errors from the SASS 1 model function.

Author (ESA)

N84-33969*# Joint Research Centre of the European Communities, Ispra (Italy).

REMOTE MONITORING OF SEDIMENTS AND CHLOROPHYLL AS TRACES OF POLLUTANT MOVEMENTS IN A MEDITERRANEAN COASTAL AREA

G. M. FERRARI, S. R. GALLIDEPARATESI, G. MARACCI, M. OOMS, P. SCHLITTENHARDT, and S. TASSAN *In* ESA IGARSS 84: Remote Sensing: From Res. towards Operational Use, Vol. 2 p 701-707 Aug. 1984 refs

Avail: NTIS HC A15/MF CSCL 13B

A research plan to clarify whether aerospace remotely sensed data could complement and present advantages over conventional technical data for contributing to the defense of the sea and marine coastal life is introduced. The project is intended to confirm the validity of Coastal Zone Color Scanner (CZCS) algorithms for turbid (water 2-type) coastal zones; to establish correlation functions between CZCS data and transported chemical pollutants; and to calibrate, complete, and improve the numerical circulation model for the Northern Adriatic Basin. The feasibility of surveillance by remote sensing of propagation of anthropogenic pollutants in estuaries and coastal zones is reported. Author (ESA)

N84-33970*# GKSS-Forschungszentrum Geesthacht (West Germany).

THE INFLUENCE OF PERTURBING WATER PROPERTIES IN CHLOROPHYLL MAPPING

J. FISCHER (Technische Univ., Munich) and P. KOEPKE *In* ESA IGARSS 84: Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 709-713 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 06C

The influence of water content and surface roughness on chlorophyll mapping in coastal water and the open ocean is discussed. Radiation fields are shown at Coastal Zone Color Scanner wavelengths. Coastal waters usually contain a mixture of suspended matter, yellow substances, and phytoplankton. The surface is rough and may have whitecaps, depending on wind speed. All these parameters contribute to the upward radiance above the ocean surface and so have to be taken into account in adequate chlorophyll remote sensing methods. Simple relations between radiances and phytoplankton concentration have to be changed for different substance compositions. For the evaluation of chlorophyll in open ocean waters from satellite measurements, the commonly used bio-optical algorithms are quite successful. However, an improvement is likely, if the influence of whitecaps on the reflected radiation as well as the angle dependency of the underlight with $1/\cos \theta$ sub sat are taken into consideration.

Author (ESA)

N84-33972*# University of Petroleum and Minerals, Dhahran (Saudi Arabia).

DETECTION AND MONITORING OF THE 1983 NOWRUZ OIL SPILL USING AVHRR DATA

M. J. MUASHER and F. INCE *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 721-728 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 13B

Analysis of NOAA AVHRR images of oil pollution in the Persian Gulf following major damage to two wells is described. Pollution mapping is difficult due to the impossibility of approaching the wells, poor AVHRR resolution, radiometric differences in oil and water, and slick sizes observable outside the war zone. The spill amount was such that individual slicks observable in Saudi waters did not often approach a sizable fraction (quarter or half) of a pixel, which varied between 1.2 sq km at best to 16 sq km at worst. For the specific conditions of the Nowruz spill, especially the absence of any other source of data, AVHRR data are found to be useful, but not nearly sufficient in themselves, for detection and monitoring of the oil spill. Author (ESA)

N84-33973*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany).

OIL SPILL DETECTION WITH DFVLR X-BAND SLAR

H. NITHACK and F. WITTE *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 729-733 Aug. 1984

Avail: NTIS HC A15/MF A01 CSCL 13B

A SLAR working at 9.6 GHz with VV polarization operated at 1000 m above sea level was assessed for oil slick detection. The quick look images (55 scenes taken during 4 flights) show the good ability of the SLAR to detect oil slicks. After data correction (elimination of antenna pattern) oil slicks of 2 km diameter can be classified with an error 10%. The best viewing direction is perpendicular to the waves. The detection and classification quality of oil slicks strongly depends on the sea state. Author (ESA)

N84-33975*# Technical Univ. of Denmark, Lyngby.

MICROWAVE RADIOMETRY FOR OIL POLLUTION MONITORING, MEASUREMENT AND SYSTEMS

N. SKOU *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 741-747 Aug. 1984 refs

Original contains color illustrations

Avail: NTIS HC A15/MF A01 CSCL 13B

A multichannel imaging radiometer system was flown in large scale oil pollution experiments. Oil thickness and volumes are underestimated by up to a factor of 2, and the measured brightness temperatures stay at low values. The problem is due to the antenna making a linear averaging over its footprint of the brightness temperature scenario and not of the thickness distribution, and the relationship between oil thickness and brightness temperature is not linear. Computer simulations of the total measurement situation also show how a given input oil thickness scenario may be underestimated by a factor of 2 to 3 without the measured brightness temperatures reaching alarming values indicating possible ambiguity problems. Underestimation of reasonably sized slicks can be solved by simultaneous inspection of the 34 GHz channel and a lower frequency channel. Author (ESA)

N84-33981*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

SPECTRASAT: A CONCEPT FOR THE COLLECTION OF GLOBAL DIRECTIONAL WAVE SPECTRA

R. C. BEAL *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 781-786 Aug. 1984 refs

Sponsored in part by Navy

Avail: NTIS HC A15/MF A01 CSCL 17I

Spectrasat, a low altitude satellite for SAR sensing of ocean waves is proposed. The instantaneous ground swath need be sufficient only for a statistically reliable transform, of order 10 km or less. This allows a greatly reduced (with respect to Seasat) along-track antenna dimension, (1 to 2 m). The potentially overwhelming data rate problem is consequently alleviated, not only by the reduction in swath, but also by sparse sampling of the spectra, similar to the scheme planned for the ERS-1 (ESA) in its sampled wave mode. Global sampling strategies depend mainly on the scale size of storms in the open ocean, and on whether oceanographic significance can be attached to the observed fine scale evolution of the dominant wave vector. An adaptive sampling strategy, built around an onboard buffer storage and electronically steerable antenna beams, allows increased sampling in the vicinity of developing storms. Author (ESA)

N84-33982*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

THE NAVY GEOSAT MISSION RADAR ALTIMETER SATELLITE PROGRAM

C. C. KILGUS and J. L. MACARTHUR *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 787-790 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 14B

The Navy Geosat Mission to place a radar altimeter spacecraft in approximately the Seasat-1 orbit in the fall of 1984 is introduced. This mission will employ an altimeter with 3.5 cm precision at 2

m significant waveheight. An 800 km altitude, 108 deg inclination orbit will provide 3 day, near-repeat ground tracks. Dual-frequency Doppler tracking will allow precision orbit determination. Data will be stored for approximately 12 hr on the spacecraft for transmission to the satellite tracking facility. The ground system will preprocess data. Author (ESA)

N84-33995* # Marconi Co. Ltd., Chelmsford (England).

DIRECT AND INVERSE METHODS FOR OCEAN-WAVE IMAGING BY SAR

S. ROTHERAM and J. T. MACKLIN *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 865-870 Aug. 1984 refs Sponsored in part by ESA Original contains color illustrations

Avail: NTIS HC A15/MF A01 CSCL 171

The direct and inverse problems for ocean-wave imaging by SAR for the image and its power spectrum are discussed. The direct problem is reasonably well understood, but the inverse methods are not complete or optimum. However, they represent the first steps in the development of such methods, and they confirm aspects of imaging theory. Other aspects, particularly for the power spectrum, remain to be completed. Once this is done, optimum methods could be developed using Bacchus-Gilbert theory to provide the required tradeoff between resolution and speckle.

Author (ESA)

N84-34002# Hovemere Ltd., Sevenoaks (England).

FEASIBILITY STUDY ON THE APPLICATION OF FABRY-PEROT INTERFEROMETRY AND IMAGING PHOTON DETECTORS TO OCEAN COLOUR MONITORING

D. REES Paris ESA Nov. 1983 37 p refs

(Contract ESA-5242/82/F-CG(SC))

(OMD/HVM-83; ESA-CR(P)-1888) Avail: NTIS HC A03/MF A01

The application of imaging photon detectors and Fabry-Perot (FP) interferometers to ocean color monitor (OCM) and Fraunhofer line discriminator (FLD) instrumentation for the recovery of ocean surface chlorophyll concentrations from an orbiting spacecraft was investigated. The spatial and spectral performance of the separate elements in the instruments are evaluated. The signal, noise and background levels detected by an operational instrument are discussed. Practical aspects of the design and interface requirements of a first-generation imaging OCM or FLD are investigated, and the trade-off between S/N ratio, the credibility of data recovered by the instruments and the cost and complexity of the instruments are examined. The imaging photon detector (IPD) is useful due to the relative ease with which very high quality multispectral channel data can be obtained. An FLD, based on a FP interferometer and an IPD is feasible, but it is impractical to obtain a spatial resolution of 1 km or less, without using either very large optics or a very complex detector strategy.

Author (ESA)

N84-34003# European Space Agency, Paris (France).

OCEAN COLOR WORKING GROUP REPORT TO ESA OBSERVATION ADVISORY COMMITTEE Progress Report

R. FRASSETTO, M. REYNOLDS, A. MOREL, H. VANDERPIEPEN, D. SPITZER, P. Y. DESCHAMPS, and P. HOLLIGAN Jun. 1984 60 p refs Original contains color illustrations

(ESA-BR-20; ISSN-0250-1589) Avail: NTIS HC A04/MF A01;

ESA, Paris FF 60, Member States, AU, CN and NO (+20% others)

The state of the art in ocean color physics, monitoring and use is reviewed. Applications in marine biology and ecology at global, regional and local scales; coastal process and monitoring; ocean dynamics; climate research (carbon cycle of the sea, energy transfer); fisheries charts; pollution monitoring and inland water are discussed. Ocean color space missions (coastal zone color scanner and ocean color experiment) and planned missions (thematic mapper on LANDSAT-4, multispectral electronic self-scanning radiometer on MOS-1, high-resolution visible sensors on SPOT, metric camera on spacialab) are outlined. Instrument technical requirements and options for an ERS-2 ocean color mission are considered.

Author (ESA)

N84-34116# Alaska Univ., Fairbanks. Geophysical Inst.

ARCTIC ICE ISLAND AND SEA ICE MOVEMENTS AND MECHANICAL PROPERTIES Quarterly Report, 1 Oct. - 31 Dec. 1983

W. M. SACKINGER and W. J. STRINGER 1984 130 p refs

(Contract DE-AC21-83MC-20037)

(DE84-014324; DOE/MC-20047/1631; QR-1) Avail: NTIS HC A07/MF A01

Research activities are presented for the following tasks: (1) ice island; (2) intrusion of the pack ice edge in the Chukchi Sea; and (3) spray ice adhesion to offshore structure coatings. With respect to the ice island portion of this project, the following activities are planned: (1) use aerial photography, satellite imagery, and historical records to establish a time history of all of the ice shelves of Ellesmere Island; (2) establish positioning buoys on the existing ice islands to track their trajectories daily and to telemeter daily barometric pressure and temperature; (3) relate geostrophic winds to the observed trajectories; and (4) begin to build a pseudo-random model for ice island motion over the long term which would enable a determination of the probability of interaction between ice islands and offshore structures. The objective of task 2 is to investigate and analyze the causes and extent of summer time pack ice intrusions into the Chukchi Sea, which would interfere with exploration drilling and emplacement of permanent production structures. For task 3, a method for evaluating shear and tensile strengths of the interface bond between the sea spray ice layer and the structure or ship surface is planned. A second, more detailed task is to measure the mechanical properties of this bonded layer for a variety of candidate coatings, as functions of temperature, loading rate, strain rate, salinity, and ice type. DOE

N84-34905* # National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHODOLOGY FOR INTERPRETATION OF SST RETRIEVALS USING THE AVHRR SPLIT WINDOW ALGORITHM

R. W. BARBIERI, C. R. MCCLAIN, and D. L. ENDRES Sep. 1983 57 p refs

(NASA-TM-85100; NAS 1.15:85100) Avail: NTIS HC A04/MF A01 CSCL 08J

Intercomparisons of sea surface temperature (SST) products derived from the operational NOAA-7 AVHRR-II algorithm and in situ observations are made. The 1982 data sets consist of ship survey data during the winter from the Mid-Atlantic Bight (MAB), ship and buoy measurements during April and September in the Gulf of Mexico and shipboard observations during April off the N.W. Spanish coast. The analyses included single pixel comparisons and the warmest pixel technique for 2 x 2 pixel and 10 x 10 pixel areas. The reason for using multi-pixel areas was for avoiding cloud contaminated pixels in the vicinity of the field measurements. Care must be taken when applying the warmest pixel technique near oceanic fronts. The Gulf of Mexico results clearly indicate a persistent degradation in algorithm accuracy due to El Chichon aerosols. The MAB and Spanish data sets indicate that very accurate estimates can be achieved if care is taken to avoid clouds and oceanic fronts. Author

N84-34906# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

CONTOURING PROGRAM FOR GENERATION OF SEA SURFACE TEMPERATURE MAPS

M. R. STEVENSON Aug. 1984 26 p refs

(INPE-3260-RPE/464) Avail: NTIS HC A03/MF A01

A FORTRAN program written for the purpose of generating two-dimensional contoured fields of sea surface temperature is described. The program accepts temperature data that are spatially equispaced from punched cards and generates a set of points corresponding to each contour line of the specified contour interval. The program user specifies the contour interval and the program determines the range of values present in the data field and the number of contours to be generated. A search method is used whereby the boundaries of the data array are examined for the presence of contour lines. Then the search proceeds to the interior

of the data field. The program readily detects isolated maximum and minimum temperature features. The output data representing the individual contour lines are smoothed before the lines are drawn by the Calcomp plotter. The program is set for a 15 deg x 15 deg (latitude x longitude) area and the Brazilian coastline corresponding to the general area is drawn onto the chart, prior to constructing the contoured temperature field. As given in this report, the program uses a 10 inch Calcomp plotter machine.

Author

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A84-40160#

RIO PILCOMAYO-BANADO LA ESTRELLA (ARGENTINA) - LANDSAT TEMPORAL ANALYSIS OF A RIVERINE ENVIRONMENT

A. B. VIOLA, C. M. VIOLA BINAGHI (Aeroterra, S.A., Buenos Aires, Argentina), W. G. BROONER, and D. GAROFALO (Earth Satellite Corp., Chevy Chase, MD) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 111-117.

A Landsat imaging study of the Rio Pilcomayo-Banada La Estrella area landscape and its temporal dynamics is discussed. The principal objective of the project was to study temporal hydrological changes, physiography, and land cover in the project area as well as climatological, hydrological, and ground-collected data. A Landsat multispectral classification involving a combined unsupervised/supervised technique was used to map twelve land cover categories over an area of about 1.5 million hectares. A digital temporal change analysis provided quantitative data on different surface hydrology conditions over three Landsat image dates.

C.D.

A84-40168#

REMOTE SENSING INPUT AND FEEDBACK FOR HYDROLOGIC FORECASTING AND SIMULATION MODELS

E. T. ENGMAN (U.S. Department of Agriculture, ARS-Hydrology Laboratory, Beltsville, MD) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 195-204. refs

New methods of remote sensing, such as microwave and thermal infrared, can give information on the moisture status and temperature of the earth's surface. With the present technology available, this type of new information cannot be used effectively for hydrologic forecasting. However, it appears that, coupled with adequate simulation models, these remote sensing data have the potential to greatly improve hydrologic forecasting and simulation accuracies. This paper discusses different forms of remote sensing, the status of current models to use these data, and what changes must be made to incorporate this promising new form of data.

Author

A84-40186#

LIMNOLOGICAL STUDY OF THE COASTAL LAGOON 'COYUCA DE BENITEZ, GRO.' DURING AN ANNUAL CYCLE (SUMMER 1981-SPRING 1982)

P. RUIZ AZUARA, A. MA. PEREZ ZEA, and MA. DEL P. SEGARRA ALBERU (Universidad Nacional Autonoma de Mexico, Mexico City, Mexico) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 423-432. refs

Preliminary results of a limnological study of water net primary productivity in the coastal lagoon Coyuca de Benitez, Guerrero, Mexico, during one annual cycle (1981-1982) are presented. Water sampling at ten sites, in situ normal and IR color photography, aerial black-and-white IR photography, and aerial MSS images in the visible and near-IR bands are employed, and the results are presented in tables, graphs, and photographs. Parameters measured include air and water temperature and water pH, depth, Secchi-disk transparency, superficial velocity, dissolved O₂, conductivity, hardness, total suspended solids, salinity, and chlorophyll-a. The usefulness of aerial IR photographs in detecting surface current patterns and a possible inverse relationship between chlorophyll-a concentration and MSS channel-2 (620-670-nm) reflectance are indicated.

T.K.

A84-40207#

SATELLITE SENSING OF TUTICORIN PORT AND ENVIRONS ON THE EAST COAST OF INDIA

S. THIRUVENGADACHARI, P. SUBBA RAO, and K. R. RAO (National Remote Sensing Agency, Hyderabad, India) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 693-702. refs

In recent years, significant progress has been made with respect to the demonstration of the use of remote sensing techniques for the derivation of information about the character and conditions of coastal water. The present investigation is concerned with an area of the east coast of India between Rameswaram island at the north and Kanyakumari at the southernmost tip of India. This coastline includes the port of New Tuticorin. Landsat data acquired on 10 different dates are considered. The obtained results show the feasibility of an employment of satellite sensed data for studying coastal features and processes at the long coastline which might be affected by the Tuticorin harbor.

G.R.

A84-40211#

HYDROGEOLOGICAL EVALUATION OF QATAR PENINSULA USING LANDSAT IMAGERY AND GEOPHYSICAL DATA

M. A. YEHAIA (University of Qatar, Doha, Qatar) and I. E. HARHASH (Ministry of Industry and Agriculture, Qatar) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 737-747. refs

The geomorphology of the Qatar Peninsula is characterized on the basis of Landsat images and electrical resistivity measurements (Seltrist, 1980), with a focus on the ground-water possibilities. The Landsat channel 4 and 5 image is processed electronically using the color slicing technique of Steiner et al. (1975); considerable matching is found between the image and the iso-resistivity map. The soil and surface deposits, carbonate rocks, unconsolidated sediments, and coastal plains of the two main (northern and southern) regions identified are briefly described.

T.K.

A84-40213#

SATELLITE SENSING OF DROUGHTS IN INDIAN ARID AND SEMIARID ZONES

S. THIRUVENGADACHARI (National Remote Sensing Agency, Hyderabad, India) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 761-770. refs

A84-40229#

A CONCEPTUAL METHOD OF SNOWMELT RUNOFF FORECAST

A. K. BAGCHI (Roorkee, University, Roorkee, India) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 945-951. Research supported by the Indian Space Research Organization. refs

A technique for estimating snow depth and snowmelt runoff from Landsat images and available ground data is presented. The test area covers the Beas basin, 345 sq km ranging in altitude from 1900 to 5900 m, in the western Himalayas; daily temperature, precipitation, and river-discharge data are available from one station. A model of snowfall which takes the orographic increase in precipitation into account is developed, and expressions for snowmelt, snow depth, and snowmelt runoff are derived. A critical input parameter, the transient snowline altitude, is obtained by projecting Landsat imagery at 1:1 million onto a 1:100,000 map of the basin with 40-m contours; data are shown in graphs for the periods November-October, 1977-1978 and 1978-1979. Good agreement is found between the predicted and observed runoff.

T.K.

A84-40237#

USE OF LANDSAT IMAGERY FOR GEOLOGICAL AND HYDROLOGICAL MAPPING

J. ULIBARRENA (La Plata, Universidad Nacional, La Plata, Argentina), A. ROJO (Catedra de Hidrogeologia, La Plata, Argentina), and C. SCHROEDER (Instituto de Ciencia y Tecnica Hidrica, La Plata, Argentina) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 1041-1049. refs

Some examples of different applications of Landsat imagery are presented, in order to determine the usefulness of Landsat imagery in geological and hydrological studies. The images are used to prepare hydrological and geological maps of two areas in Argentina: Port Deseado, in the province of Santa Cruz, and the Grande Island of Tierra del Fuego. Characteristic features of the vegetation, climate, drainage systems and hydrological mechanisms of these areas are also interpreted from the Landsat images. It is found that the Landsat imagery is very useful in discriminating between various features of areas with marked seasonal changes and with adverse climatic conditions which limit opportunities for ground studies.

I.H.

A84-40425

MAPPING PREVIOUSLY UNMAPPED PLANETARY SURFACE - A SUPERVISED MULTISPECTRAL TERRESTRIAL/AQUATIC APPROACH IN NORTHEASTERN FINLAND

J. RAITALA, H. JANTUNEN, and J. LAMPINEN (Oulu, University, Oulu, Finland) Earth, Moon, and Planets (ISSN 0167-9295), vol. 30, June 1984, p. 295-311. Research supported by the Foundation for Research of Natural Sciences. refs

An example of the aquatic environment research by computer-assisted remote sensing using Landsat MSS data is presented. The western parts of Lake Yli-Kitka in northeastern Finland have been studied and mapped according to spectrally identified classes. The physical, chemical, and biological characteristics of the lake are described, and the Landsat data interpretation method is summarized. The reference fields are described and the classification stages are given in detail.

C.D.

A84-41754

HIPLEX-1 - EXPERIMENTAL DESIGN AND RESPONSE VARIABLES

P. L. SMITH, H. D. ORVILLE, J. R. MILLER, JR. (South Dakota School of Mines and Technology, Rapid City, SD), A. S. DENNIS, B. A. SILVERMAN (U.S. Bureau of Reclamation, Div. of Atmospheric Resources Research, Denver, CO), A. B. SUPER, E. W. HOLROYD, III (U.S. Bureau of Reclamation, Montrose, CO), W. A. COOPER (Wyoming, University, Laramie, WY), P. W. MIELKE, JR., and K. J. BERRY (Colorado State University, Fort Collins, CO) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 23, April 1984, p. 497-512. Sponsorship: U.S. Department of the Interior. refs
(Contract DI-8-07-83-V0009)

The design and conduct of HIPLEX-1, a randomized seeding experiment carried out on small cumulus congestus clouds in eastern Montana, are outlined. The seeding agent was dry ice, introduced in an effort to produce microphysical effects, especially the earlier formation of precipitation in the seeded clouds. The earlier formation was expected to increase both the probability and the amount of precipitation from those small clouds with short lifetimes. The experimental unit selection procedure, treatment and randomization procedures, the physical hypothesis, measurement procedures and the response variables defined for the experiment are discussed. Procedures used to calculate the response variables from aircraft and radar measurements are summarized and the values of those variables for the 20 HIPLEX-1 test cases from 1979 and 1980 are tabulated.

Author

A84-41756

PHYSICAL INTERPRETATION OF RESULTS FROM THE HIPLEX-1 EXPERIMENT

W. A. COOPER and R. P. LAWSON (Wyoming, University, Laramie, WY) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 23, April 1984, p. 523-540. Sponsorship: U.S. Department of the Interior. refs
(Contract DI-7-07-83-V0001; NSF ATM-82-11134)

The general characteristics of the clouds that were included in the HIPLEX-1 experiment are reviewed, and the results for the response variables are interpreted in light of other measurements from the instrumented aircraft. In most seeded clouds, the HIPLEX-1 experimental hypothesis corresponded with the observed precipitation development for only about the first 8 min after seeding. The failure to obtain a stronger statistical result is attributed to the inherent inefficiency of the small cumulus congestus selected as experimental units. This inefficiency was only partly due to low ice concentrations; a more significant cause of the low precipitation efficiency was the limited lifetime and low liquid water content of these clouds. Some calculations which indicate that these clouds could not support a rapid enough accretional growth process to lead to precipitation after seeding are discussed. Other reasons for the successes and failures of the experiment are discussed.

Author

A84-41979

FLOOD STRESS MAPPED NOAA-7 DATA

D. G. MCCRARY (NOAA, National Environmental Satellite Service, Houston, TX) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 293-295.

NOAA-7 satellite data are used to map floods that occurred in North Texas during the Fall of 1981. In addition, runoff is detected as it enters the lakes. The Gray-McCrary Index, NOAA-n Channel 2-Channel 1, is used to map the flooded area by the use of a classifier which plots the index pixel-by-pixel for pre-determined I-J grid cells. Changes in surface water area are then computed. Runoff into the lakes is detected by the same classifier and it

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demonstrates how the crest of a flood could possibly be tracked on the major rivers over the world. Author

A84-41981

DIGITAL ANALYSIS OF LANDSAT DATA IN THE ATHABASCA DELTA

J. HARPER and G. A. ROSS (Calgary, University, Calgary, Canada) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 319-327. Research supported by the Alberta Remote Sensing Center.

A digital analysis technique was applied to multispectral aerial photography of the Athabasca Delta in Canada to simulate Landsat data and assess their suitability for environmental monitoring of the area. The photographs were examined to define water, swamp, point bar, shrubbed basins, levees and mud flats classifications. Criteria were established for identifying geomorphological features on the basis of 200 sample pixels from each image. Predicted group memberships were generated. It was found necessary to include pixels from all parts of a photograph to obtain higher accuracy. The technique was judged insufficiently accurate for monitoring the area due to the small sizes of significant features and the complexity of the area. M.S.K.

A84-41991

COMPUTER GENERATION OF A LAKE DATA FILE FROM LANDSAT DIGITAL DATA

J. C. MELLOR (U.S. Bureau of Land Management, Fairbanks, AK) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 449-458. Research supported by the U.S. Department of Energy.

A computer software system has been developed that manipulates Landsat digital data to compile a master file of lakes and their computer calculated surface features (i.e., area, perimeter, crenulation and centroid). Although the system has worldwide capability in areas of flat terrain, it was conceived as a potential solution to inventory lakes and manage regional data for tens-of-thousands of un inventoried/unenumerated Alaskan Arctic Coastal Plain Lakes. The latitude and longitude of each lake centroid uniquely identify each lake in the data files, providing for retrieval by user specified geographic area. The data files contain all system calculated surface features from Landsat data and space for additional data from other sources. Sorting and filtering functions applied through retrieval of these data provide a lake classification capability. Proposed uses of this system include: rapid lake inventory, change detection through repetitive inventory, consolidation of aquatic data, and supplementation or replacement of conventional means of regional lake data management and analysis. Author

A84-41992

UTILIZING LANDSAT DIGITAL DATA FOR OPERATING TWO HYDROLOGIC MODELS

H. MOYSEENKO, M. YARAMANOGLU, and L. WANCHOO (Maryland, University, College Park, MD) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 459-472. Research supported by the University of Maryland. refs

Two hydrologic models were tested for compatibility with Landsat MSS imagery. A subscene for a Landsat image from 1978 was classified and the areal percentages of land uses with a test watershed were segregated. Six uses were categorized: forests, grass or crops, low density housing, impervious areas such as parking lots, medium density housing and bare soil or mining areas. A continuous simulation model and a storm simulation model predicted flood discharges and monthly runoffs, and ground truth data were gathered. Peak flow rates were adequately predicted by both models using parameters partially derived from Landsat imagery. The imagery furnished the land-use areal percentages, thereby enhancing the watershed discretization process. A larger ground truth data base would be needed for long-term predictions. M.S.K.

A84-43204

INVESTIGATION OF THE VOLGA RIVER DELTA ON THE BASIS OF SPACEBORNE PHOTOGRAPHY DATA [IZUCHENIE DEL'TY REKI VOLGI S POMOSHCH'YU MATERIALOV KOSMICHESKOI FOTOS'EMKI]

G. F. KRASNOZHON and I. U. S. SOKOLOV (Akademiia Nauk SSSR, Institut Vodnykh Problem, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 27-32. In Russian. refs

The use of space photographs to map deltas is examined, and a hydrographic map of the Volga delta compiled on the basis of space photographs is presented. A comparison of this map with the hydrographic map of 1910 elucidates the dynamics of the Volga delta in the course of 65 years. B.J.

A84-43210

THE PERMITTIVITY OF WATER - THE NECESSITY OF PRECISE VALUES FOR SOLVING REMOTE-SENSING PROBLEMS [DIELEKTRICHESKAIA PRONITSAEMOST' VODY - NEOBKHODIMOST' TOCHNYKH ZNACHENII DLIA RESHENIIA ZADACH DISTANTSIONNOGO ZONDIROVANIIA]

L. M. MITNIK (Akademiia Nauk SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 66-71. In Russian. refs

A number of characteristics were analyzed in the 0.5-200 GHz frequency range: (1) variations of the emission coefficients of a smooth water surface; (2) the penetration depths of electromagnetic waves into water; and (3) absorption coefficients and phase delay in clouds due to water-permittivity errors. Two error sources are examined: (1) errors in the measurement of water permittivity; and (2) the indeterminacy of water-temperature values. Calculations are carried out for fresh and salt (35 percent) water over a wide temperature range. B.J.

A84-43533

AN ESTIMATE OF ICE-COVER PERCENTAGE ON LAKE LADOGA WITH THE HELP OF REMOTE SENSING TECHNIQUES [OTSENKA LEDOVITOSTI LADOZHSKOGO OZERA S POMOSHCH'U DISTANTSIONNYKH SREDSTV]

V. G. PROKACHEVA and V. V. BORODULIN (Gosudarstvennyi Gidrologicheskii Institut, Leningrad, USSR) Meteorologiya i Gidrologiya (ISSN 0130-2906), July 1984, p. 84-89. In Russian. refs

On the basis of long-term aerial reconnaissance and surveys made by the Meteor satellite the probable characteristics of ice cover percentage over Lake Ladoga are calculated. A relationship is established between the lake ice-cover percentage and the characteristic time when ice disappears from the lake, making it possible to forecast the development of ice-cover. I.H.

A84-44136

NONTIDAL WETLAND MAPPING IN SOUTH CAROLINA USING AIRBORNE MULTISPECTRAL SCANNER DATA

J. R. JENSEN (South Carolina, University, Columbia, SC), E. J. CHRISTENSEN, and R. SHARITZ (DuPont de Nemours and Co., Savannah River Laboratory, Aiken, SC) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 1-12. Research supported by DuPont de Nemours and Co. refs (Contract EY-76-C-09-0819)

High resolution multispectral scanner (MSS) imagery of Savannah River nontidal wetlands were analyzed to identify (1) useful spectral bands for discriminating among National Wetland Inventory classes, (2) where the classes cluster in n-dimensional feature space, and (3) what wetland classification accuracies can be expected. Spectral measurements in the green, red, and near-infrared wavelengths provided the most useful information. Emergent marsh (both persistent and nonpersistent), scrub-shrub, mixed deciduous swamp forest, and mixed deciduous upland forest were found to cluster in somewhat predictable regions of two- and three-dimensional feature space. The overall classification accuracy of the Steel Creek delta study area was 83 percent and was assessed by comparing the remote sensing derived thematic map with 1325 linear meters of transects sampled in situ. These results suggest that high resolution aircraft MSS data can provide detailed vegetation type information for mapping both thermally affected and rejuvenating nontidal wetland in the South Carolina Savannah River Swamp System. Author

A84-44701

PHYSICAL ASPECTS AND DETERMINATION OF EVAPORATION IN DESERTS APPLYING REMOTE SENSING TECHNIQUES

M. MENENTI Wageningen, Netherlands, Instituut voor Cultuurtechniek en Waterhuishouding, 1984, 211 p. refs

The importance of groundwater losses by evaporation in deserts is shown to be an important and almost unknown quantity in the aquifer water balance. A new combination formula to calculate actual evaporation from within soil is established, and physical aspects of evaporation from soil are discussed. It is shown that under specified conditions vapor flow can occur against the direction of heat flow. A new, fundamental definition of evaporation sites is given and its bearing on a model of heat and moisture flow is discussed. A theory of heat exchange at the soil-air interface is presented in terms of the apparent soil thermal admittance. Equations to relate the latter soil property to soil layering and to the frequency of the surface temperature wave are given. A theory of evaporation in terms of multidimensional geometry is proposed and the derivation of approximate formulas to calculate actual evaporation using satellite data only is shown. The theory is combined with experimental data to calculate the surface energy balance and actual evaporation from Libyan desert. C.D.

N84-29277*

California Univ., Santa Barbara. Dept. of Geography.

LANDSAT-D INVESTIGATIONS IN SNOW HYDROLOGY Quarterly Progress Report, 1 Apr. - 30 Jun. 1984

J. DOZIER, Principal Investigator 30 Jun. 1984 6 p refs ERTS

(Contract NAS5-27463)

(E84-10156; NASA-CR-173668; NAS 1.26:173668) Avail: NTIS HC A02/MF A01 CSCL 08L

Two stream methods provide rapid approximate calculations of radiative transfer in scattering and absorbing media. Although they provide information on fluxes only, and not on intensities, their speed makes them attractive to more precise methods. The methods provide a comprehensive, unified review for a homogeneous layer, and solve the equations for reflectance and transmittance for a homogeneous layer over a non reflecting surface. Any of the basic kernels for a single layer can be extended to a vertically inhomogeneous medium over a surface whose reflectance properties vary with illumination angle, as long as the medium can be subdivided into homogeneous layers. M.A.C.

N84-29299#

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Lab.

PRELIMINARY GUIDE TO THE ONSITE IDENTIFICATION AND DELINEATION OF THE WETLANDS OF ALASKA Final Report

R. T. HUFFMAN and G. E. TUCKER Feb. 1984 116 p (AD-A142091; WES/TR/Y-78-9) Avail: NTIS HC A06/MF A01 CSCL 08F

This guide to the major wetland plant associations and communities found in Alaska is one of a series of eight such guides, each prepared by a specialist or specialists familiar with the wetlands in the region covered by the guide. The guides are intended for distribution to the various U.S. Army Engineer Districts for use in the onsite technical identification and delineation of wetland boundaries. The classification system in this guide is adapted from that utilized by the National Wetlands Inventory (NWI) Project of the U.S. Fish and Wildlife Service, but frequently departs from NWI's system to describe common and/or distinct wetland communities or associations. GRA

N84-30425*#

Department of Agriculture, Washington, D.C. A FIRST EVALUATION OF LANDSAT TM DATA TO MONITOR SUSPENDED SEDIMENTS IN LAKES Abstract Only

F. R. SCHIEBE, J. C. RITCHIE, and G. O. BOATWRIGHT In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 141 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

A comparison was made between ground data collected from Lake Chicot, Arkansas, and Thematic Mapper (TM) data collected on September 23, 1982. A preliminary analysis of limited data indicate that Thematic Mapper data may be useful in monitoring suspended sediment and chlorophyll in a lake with high suspended sediment loads. Total suspended loads ranged from 168 to 508 mg/l. TM Band 3 appears to be most useful with Bands 1, 2 and 4 also containing useful information relative to suspended sediments. Considering water data only, Bands 1, 2 and 3 appear to provide similar information. Bands 3 and 4 are also significantly related. Bands 5 and 7 appear to have independent information content relative to the presence or absence of water. Insufficient range of water temperature ground truth data made an evaluation of TM Band 6 difficult. M.G.

N84-30426*#

California Univ., Santa Barbara. SNOW REFLECTANCE FROM LANDSAT-4 THEMATIC MAPPER

J. DOZIER In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 142-147 Jul. 1984 refs ERTS

Avail: NTIS HC A09/MF A01 CSCL 08L

In California 75% of the agricultural water supply comes from the melting Sierra Nevada snowpack. Basin-wide albedo measurements from the LANDSAT-4 Thematic Mapper could be

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used to better forecast the timing of the spring runoff, because these data can be combined with solar radiation calculations to estimate the net radiation budget. The TM is better-suited for this purpose than the MSS because of its large dynamic range. Saturation still occurs in bands 1-4, but is severe only in band 1. Differentiation of snow optical grain size is possible with TM band 4 through a moderately clear atmosphere. The TM band 5 can discriminate clouds from snow, and the combination of bands 2 and 5 appears best for snow mapping. Author

N84-30431*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF LAND COVER INFORMATION FROM LANDSAT MULTISPECTRAL SCANNER (MSS) AND AIRBORNE THEMATIC MAPPER SIMULATOR (TMS) DATA FOR HYDROLOGIC APPLICATIONS

J. C. GERVIN, Y. C. LU (Computer Sciences Corp., Silver Spring, Md.), and R. F. MARCELL (Computer Sciences Corp., Silver Spring, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 167-170 Jul. 1984 ERTS
Avail: NTIS HC A09/MF A01 CSCL 08B

Detailed land cover classifications were performed on the Thematic Mapper Simulator (TMS) and MSS data of the Clinton River Basin (acquired on August 19, 1981, and June 28, 1980, respectively) using supervised classification techniques. Differences in interclass separability were compared to select several promising TMS band combinations, selected from the 27 covering the Clinton River Basin. The TMS data produced a more accurate and spatially contiguous classification than MSS for this study site. While the accuracy of the 4-band TM data set was as good as the 7-band, the 3-band TMS data sets were also better than the MSS. These results indicate that both the increased spectral discrimination and spatial resolution contribute to improved classification accuracy. The possibility of reducing the data analysis burden associated with large TM data volumes through effective band selection therefore appears promising. The implications of the improved classification accuracy of TMS data are important for hydrologic and economic modeling. In particular, the higher accuracies for the developed categories (residential and commercial) should improve the predictions of runoff in flood forecasting models and of flood damage for damage calculation models appreciably. M.G.

N84-30434*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GLOBAL HYDROLOGIC CYCLE

A. RANGO *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A1-A4 Aug. 1984
Avail: NTIS HC A04/MF A01 CSCL 08H

One of the major scientific questions in hydrology is: Can remote sensing data be used effectively with models to improve our understanding of hydrologic processes? Virtually all hydrologic models, with only a few exceptions, were designed to interface with conventional point data. These models must be modified or new ones developed to be compatible with remote sensing capabilities (areal coverage, high spatial resolution, repetitiveness, etc.). A comprehensive program of development and testing of these models at various application scales ranging from flash flood modeling and small tributary streams to continental size general circulation models must be carried out. Author

N84-30438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INLAND AQUATIC RESOURCES AND BIOGEOCHEMICAL CYCLES

J. M. MELACK *In its* Earth Observing System. Vol. 1, pt. 2: Sci. and Mission Requirements p A15-A17 Aug. 1984
Avail: NTIS HC A04/MF A01 CSCL 13B

The biosphere is the entire planetary system that includes, sustains and is influenced by life. The central issue of the science of the biosphere is the extent to which the Earth's surface, atmosphere and hydrosphere is the result of biological rather than abiotic processes. Space science and technology accelerates the

understanding of global biological processes by providing repetitive synoptic observations on large spatial scales once the relationships between the processes and the remotely sensed quantities are established. Especially promising applications of space technology are the measurement of biological productivity and portions of geochemical cycles in aquatic ecosystems and the evaluation and management of the quality of freshwater resources. Author

N84-30668*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A FRAMEWORK FOR WETLANDS RESEARCH: DEVELOPMENT OF A WETLANDS DATA BASE

In its Global Biol. Res. Program. Biogeochem. Process. in Wetlands p 14-32 Aug. 1983

Avail: NTIS HC A03/MF A01 CSCL 13B

Issues related to the assembly of a comprehensive global wetlands data base are presented. A strategy to collect relevant data for wetland ecosystems through remote sensing inventories of wetland distribution was discussed. Elements of a research program on biogenic gas fluxes were identified. The major wetland parameters and their functional importance to material exchange mechanisms are summarized. R.S.F.

N84-31735*# Hydrex Corp., Fairfax, Va.

A METHOD TO COMBINE REMOTELY SENSED AND IN SITU MEASUREMENTS: PROGRAM DOCUMENTATION Interim Report

E. L. PECK, E. R. JOHNSON, and M. Y. WONG Greenbelt, Md. NASA. Goddard Space Flight Center May 1984 94 p refs
Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS5-27554; PROJ. AGRISTARS) (E84-10172; NASA-CR-175270; NAS 1.26:175270) Avail: NTIS HC A05/MF A01 CSCL 05B

All user and programmer information required for using the correlation area method (CAM) program is presented. This program combines measurements of hydrologic variables from all measurement technologies to produce estimated areal mean values. The method accounts for sampling geometries and measurement accuracies and provides a measure of the accuracy of the estimated mean areal value. A.R.H.

N84-32899# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

DCP SYSTEMS AND CHARACTERISTICS

A. D. MOURA Nov. 1983 9 p refs Presented at the 8th UN/FAO Training Course on Appl. of Satellite Remote Sensing to Water Resources, Rome, 19 Sep. 7 Oct. 1983 (INPE-2948-PRE/431) Avail: NTIS HC A02/MF A01

Collection platforms used with the GOES and NOAA (TIROS-N) satellites are considered as well as their use for water resources. The capabilities of the ARGOS data collection system is described and the advantages of such a system are compared with characteristics of conventional systems. Types of measurement and precision for various hydrological applications are examined. Data processing and dissemination are discussed. A.R.H.

N84-33444# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SATELLITE TELEMETRY [TELEMETRIA POR SATELITE]

J. R. DEOLVEIRA Aug. 1983 15 p refs *In* PORTUGUESE Presented at the 5th Simposio Brasileiro de Hidrologia e Recursos Hidricos, Blumenau, 13-18 Nov. 1983 (INPE-2854-PRE/394) Avail: NTIS HC A02/MF A01

Hydrologic application of satellite data collection systems in Brazil is discussed. The Data Collection Platform (DCP) is a telemetry station used for the acquisition of environmental parameters. Artificial satellites are employed to relay the data to receiving centers. Two meteorologic satellite data collection systems are in operation in Brazil: the ARGOS system, on board low-orbit (850 km) satellites of the TIROS-NOAA series, and the Geostationary Operational Satellite (GOES) system, on board geostationary satellites (36,000 km) of the SMS/GOES series.

DCPs have been used mainly in the field of hydrology to obtain timely data, to make decisions, and to compose historical records. The first DCP network established in Brazil was in the Tocantins Basin, which has 10 telemetry stations. Other networks are currently being planned. Prototypes of ARGOS and GOES DCPs are being developed that are aimed at further industrialization and improved supply of national demand. Transl. by B.G.

N84-33851# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ON THE USE OF METEOROLOGIC SATELLITES IN HYDROLOGY [O USO DE SATELITES METEOROLOGICOS EM HIDROLOGIA]

L. C. B. MOLION Sep. 1983 15 p refs In PORTUGUESE Presented at the 5th Simposio Brasileiro de Hidrologia e Recursos Hidricos, Blumenau, 13-18 Nov. 1983

(INPE-2879-PRE/404) Avail: NTIS HC A02/MF A01

Meteorologic satellites serve several functions in the field of hydrology. Forecasts of river flow reaching reservoirs and quantitative precipitation forecasts depend heavily on weather analysis and prediction. Both activities are improved significantly when satellite data are added to conventional climatologic data. Rainfall can be estimated from satellite imagery, and satellites can be used to relay data collected through automatic stations. The great advantages of this type of data collection system are the timely acquisition of hydrologic data and the low cost involved in the long range operation, since the transmission of these data does not depend on the particular distance to be covered between the transmitting and receiving stations. The two types of operational meteorologic satellites, geostationary and polar orbit, are described, and use of their imagery in hydrology is discussed. B.G.

N84-33903# Bonn Univ. (West Germany).

A SPLASH AND SHEET EROSION MODEL FROM LANDSAT DATA

M. C. MUEKSCH In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 295-299 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

A splash erosion model from LANDSAT data, using linear measurements of slope length, is presented. Relief data and rain intensity are introduced by relationships between slope length and slope inclination from empirically gained formulas and climatological observations. By setting the soil loss equal to the sediment splashed, an erosion factor is computed for a map delineated area and its respective satellite scene from which a transition factor to the reality is related. The soil loss on different slope profiles, the total soil loss, soil constants and the relative splash and sheet erosion are edited for various rainfall intensities and removed vegetation canopy, i.e., increased bare soil surface and vegetation damage. The model works as a quick-look procedure for estimation of quantitative regional erosion and its development. Author (ESA)

N84-33904# Freiburg Univ. (West Germany).

CALCULATION OF FLOOD HYDROGRAPHS USING SATELLITE-DERIVED LAND-USE INFORMATION IN THE DREISAM WATERSHED, S. W. GERMANY

W. MAUSER In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 301-304 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Flood hydrographs in a watershed were calculated using a geographical data base including satellite derived land use, soil information and slope with a resolution of 64x104 m. The land use information is a result of a maximum likelihood classification of LANDSAT MSS data. As model for the calculation of the flood hydrographs the SCS-TR 20 was used. The single event calculations and calculations using 24-hr storms of selected return periods match the measured hydrographs well. The effect of a possible deforestation of the area due to forest damage was simulated using five scenarios. According to the simulations a total

deforestation in the watershed will cause a 100-yr peak discharge 5 times as high as today's. Author (ESA)

N84-33927# Radio Research Labs., Tokyo (Japan).

REMOTE SENSING OF RAIN BY AN AIRBORNE DUAL-FREQUENCY SCATTEROMETER/RADIOMETER

M. FUJITA, K. OKAMOTO, H. MASUKO, T. JIMA, and N. FUGONO In ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 437-441 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Airborne dual-frequency microwave scatterometer/radiometer data are analyzed to infer rain rate measured from topside. The equation of radiative transfer is used to relate rain rate profile measured by the scatterometer to antenna temperature measured by the radiometer. The influence of the ocean surface temperature is evaluated by a model computation. The effect of non uniform rain in the vertical direction on the measurements of antenna temperature is also evaluated using the experimental data. Excess antenna temperature, delta TB (difference between the antenna temperature under raining and no-rain condition) and path-integrated rain rate, R integ, are related at 10GHz band as: delta TB = 1.18 R integ. Author (ESA)

N84-34001# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).

INVESTIGATION OF TEXTURING FUNCTIONS. APPLICATION TO ECOGRAPHICAL ZONING AND TO MAPPING LAND USE IN A SLOPING BASIN: THE AVEYRON Progress Report, July 1981-June 1983 [RECHERCHE DE FONCTIONS TEXTURANTES, APPLICATIONS AU ZONAGE ECONOGRAPHIQUE ET A LA CARTOGRAPHIE DE L'OCCUPATION DES TERRES D'UN BASSIN VERSANT: L'AVEYRON]

G. FLOUZAT Sep. 1983 65 p refs In FRENCH Sponsored by CNRS

(CESR-83-1089) Avail: NTIS HC A04/MF A01

The use of computer aided mapping and satellite remote sensing to draw up a land use map of a river basin to facilitate hydrobiological management is described. A texture analysis theory compatible with analytical photointerpretation was developed. A second order image processing method was used. Author (ESA)

N84-35039# National Science Council, Taipei (Taiwan).

REMOTE SENSING OF COASTAL ENVIRONMENT: THE ESTUARINE PROCESSES OF TA-TU RIVER Abstract Only

J. M. LU (ITRI) In its Sci. Res. Abstr. in Republic of China, 1983 p 4 Jun. 1984

Avail: Issuing Activity

Multi-temporal LANDSAT MSS imagery, aerial photographs, and digital multispectral scanner data taken from 1972 to 1982 were used to study the estuarine processes. All the remotely sensed data revealed an unusual abundance, variety, and distinctness of discoloration and turbidity patterns and proved suitable for both qualitative and quantitative studies. The estuary of the Ta-Tu river was selected as the study area, which was seriously polluted by urban sewage and industrial waste water. This estuary lies in the central part of the western coast of Taiwan island, and is about 7.5 Km south of Taichung harbor. On the southern side of this estuary, a huge coastal industrial park is under construction on the tidal flats. The qualitative approach was used to map the polluted water plumes discharged in different oceanographic seasons and tidal conditions, while the quantitative analyses in which sea truth collected at a limited number of locations were used to calibrate remotely sensed digital data and to extend the results to the whole scene. The estimation of the relative importance and time-scale of the variety of physical parameters influencing the study area was made. Moreover, in summer season, the water motion were measured quantitatively from successive photographs in which the turbidity patterns remain recognizable from one photograph to the next. And a mathematical model was developed to simulate the process of this river. R.J.F.

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A84-39790

SOME ENERGY CONSERVING METHODS IN MULTISPECTRAL IMAGE PROCESSING

R. LAAN (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 4, 1983, p. 334-340.

Two methods of processing multispectral images are described. Both follow the principle that for each pixel the total reflected energies before and after processing are equal by decomposing the energy vectors onto an axis system in the amplitude domain. This domain is chosen because orthogonal decompositions keep constant the sum of the squares of the components of any vector and because the energies are proportional to the square of amplitudes. Using these methods, energy vectors are transferred to the amplitude domain and decomposed onto an orthogonal axis system (single cluster method) or a non-orthogonal axis system (several clusters method) and the new vectors are transferred back to the energy domain. Both methods yield non-conventional images in which selected phenomena are enhanced in selected colors.

Author

A84-40179*# Alabama Univ., Huntsville.

SEVERE CONVECTIVE STORM DETECTION BASED ON SATELLITE INFRARED IMAGERY ANALYSIS

R. J. HUNG (Alabama, University, Huntsville, AL) and R. E. SMITH (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 329-341. refs

(Contract NAS8-33726)

Several cases of GOES digital infrared data and Doppler Sounder array data during the three-hour time period immediately preceding the touchdown of the tornado were analyzed. Tornado-associated clouds are compared with non-tornado-associated clouds using satellite infrared data, ray tracing of gravity waves detected by the Doppler Sounder array and rawinsonde data. The satellite observations are at 15-minute intervals. Our study shows that tornado-associated clouds are always accompanied by overshooting turrets penetrating above the tropopause. The growth rate of the overshooting turret above the tropopause for severe storm-associated clouds is much greater than that for non-severe storm-associated clouds.

Author

A84-40184#

BIOPHYSICAL MAPPING OF THE REPUBLIC OF HAITI THROUGH THE USE OF ENHANCED LANDSAT IMAGERY

B. KIENTZ (Societe Francaise d'Etudes et de Recherches Economiques et Statistiques, Paris, France), W. A. TYLER (Michigan, Environmental Research Institute, Ann Arbor, MI), and L. A. RIVARD (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 393-405. refs

A84-40206#

A FUNDAMENTAL APPROACH TO TEMPORAL DATA ANALYSIS

Y. KAWATA, T. KUSAKA, and S. UENO (Kanazawa Institute of Technology, Kanazawa, Ishikawa, Japan) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 681-691. refs

In the present study, a description is provided of a method to estimate the optical thickness of the atmospheric haze from a Landsat data set itself. Then attention is given to a conversion method from the original CCT level data to the true ground albedo data with the aid of the Atmospheric Effect Correction System developed at the Kanazawa Institute of Technology. It is also shown that the signature extension becomes possible by correcting the original Landsat data for the atmospheric effects, and this approach will be a powerful tool in temporal data analysis. Finally, a processing system implementing the signature extension of the remotely sensed data is described. As for such a signature extension system, a new and powerful table look-up method in classification and a data base containing the statistical information on albedos for various ground classes with time are introduced.

Author

A84-40222#

LAND COVER MAPPING IN PARTS OF SOUTH GUJARAT AND TAMIL NADU STATES OF INDIA USING BHASKARA-I TV DATA

A. R. DASGUPTA, I. C. MATIEDA, S. D. NAIK, K. L. MAJUMDAR, J. S. PARIHAR, S. K. PATHAN, and P. D. YADAV (Space Applications Centre, Ahmedabad, India) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 865-873.

The Indian government's experience in launching its first remote sensing satellite, Bhaskara, is described. The satellite was launched under a collaborative agreement with the USSR on June 7, 1979. The satellite carried on board a two-camera TV system operating in the range of 0.54-0.66 and 0.75 to 0.85 micrometers. The analysis of Bhaskara images of two test areas are described; one in the South Gujarat State, and the other near Cuddalore in the Tamil Nadu State. Land cover maps are presented using bulk processed and digitally enhanced data, and an attempt was made to prepare geomorphical and geological maps of the Cuddalore region. It is found that the Bhaskara imagery yielded significant information regarding land geomorphology and geology of the study area on a regional scale of 1:2 M.

I.H.

A84-40235#

ADAPTATION OF THE SPOT SPECTRAL BANDS TO SPECTRAL SIGNATURES OF OBJECTS

G. BEGNI (Centre National d'Etudes Spatiales, Toulouse, France) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 1007-1015.

The aim of this paper is to show how the SPOT spectral bands have been adapted to the spectral properties of the observed ground objects. The text starts with generalities: a brief description of the SPOT system and of the simulations being made for future users of SPOT data, a precise description of measured radiances and reflectances, and a review of atmospheric effects. It is shown how the profiles of the three spectral bands have been optimized with respect to thematic objectives: minimization of atmospheric perturbations, spectral properties of some objects such as vegetation. It is shown how the choice between two types of panchromatic bands was made by studying contrasts between objects thematically characterized, taking into account the most interesting features to be observed by a scanner with the SPOT

resolution. The expected spectral profile for both spectral and panchromatic SPOT bands is presented. Author

A84-40547

SURFACE MATERIAL MAPPING IN THE ENGLISH FENLANDS USING AIRBORNE MULTISPECTRAL SCANNER DATA

D. W. LYNN (Reading, University, Reading, Berks., England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) *International Journal of Remote Sensing* (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 699-713. Research supported by the Natural Environment Research Council. refs

A84-41178

THE QUALITY OF SPOT IMAGES [LA QUALITE DES IMAGES SPOT]

G. BEGNI (Centre National d'Etudes Spatiales, Toulouse, France) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 33-46. In French.

The design specifications for various SPOT remote sensing components and data processing methods are examined for their impact on the quality of the projected 10/20 m resolution. The SPOT carries two high resolution visible sensors (HRV) which function in panchromatic (10 m resolution) and three spectral (20 m) modes. The sensors are equipped with movable mirrors that can adjust the image viewed 27 deg along and back on the satellite ground track. The panchromatic mode furnishes 6000 points per scan line while the spectral modes each have 3000 points per scan line. Images are sensed by four-part arrays of optoelectronic sensors that are calibrated with solar light transported into the mechanism by optic fibers. Numerical models have been devised to account for system noise and a transfer function will be fitted to the data from the optical elements. Finally, geometric criteria have been formulated on the subpixel element level to correct for localization, orbital position, anisomorphic, spectral superposition and relief-induced errors. M.S.K.

A84-41179

THE SPOT IMAGE GROUND STATION - PRESENTATION OF THE CENTER FOR SPATIAL IMAGE PROCESSING [STATION SOL IMAGE SPOT - PRESENTATION DU CENTRE DE RECTIFICATION DES IMAGES SPATIALES]

J. C. CAZAUX (Centre National d'Etudes Spatiales, Toulouse, France) and F. SALGE (Institut Geographique National, Paris, France) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 47-62. In French.

The Center for Space Imagery Processing (CRIS) is assigned the tasks of archiving SPOT and Landsat D imagery, editing the archived Landsat imagery and pretreating SPOT imagery to demand for sale. CRIS will produce standardized imagery from the archived imagery, which will be stored on magnetic tape. The imagery can have originated from the high resolution visible, thematic mapper or multispectral scanner instruments. The archived data will be cataloged in the form of 70 mm film positives and corrections for orbital dynamics, earth rotation and curvature, view angle and cloud cover. Various levels of image processing will be made available, corresponding to the level of requested accuracy. M.S.K.

A84-41180

THE SPOT SIMULATIONS PROGRAM OF THE GDTA [LE PROGRAMME DE SIMULATIONS SPOT DU GDTA]

C. TORRES (Groupement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 63-77. In French.

In 1979 the Group for the development of aerospace remote sensing (GDTA) began a series of simulations to illustrate the theoretical performance of a remote sensing satellite in terms of applications and to validate the performance of SPOT components being manufactured. Sample imagery were constructed for expected typical imagery gathered with airborne instrumentation. Standard techniques were developed for image processing and were linked with geometric and radiometric criteria. Efforts were directed to identifying qualities needed for cartography, silviculture, hydrology, geology, agriculture, land use, environmental protection and city planning. Sample imagery of NW Africa and Paris are provided. M.S.K.

A84-41181

CARTOGRAPHIC APPLICATIONS OF SPOT AT THE INSTITUT GEOGRAPHIQUE NATIONAL, FRANCE [LES APPLICATIONS CARTOGRAPHIQUES DE SPOT A L'INSTITUT GEOGRAPHIQUE NATIONAL - FRANCE]

A. BAUDOUIN (Institut Geographique National, Paris, France) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 85-97. In French. refs

A84-41184

ECOLOGICAL MAPPING WITH THE HELP OF SIMULATED SPOT DATA [CARTOGRAPHIE ECOLOGIQUE A L'AIDE DE DONNEES SPOT SIMULEES]

R. AUDET and G. ROCHON (Universite Laval, Sainte-Foy, Quebec, Canada) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 125-131.

A84-41186

COMPARISON STUDY BETWEEN RESULTS OF A SPOT SIMULATION AND THE LANDSAT SATELLITE DATA OBTAINED ON THE SAME DATE [ETUDE COMPAREE DES RESULTATS OBTENUS A LA MEME DATE PAR UNE SIMULATION SPOT ET PAR LE SATELLITE LANDSAT]

A. COMBEAU (Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris, France) IN: *Colloquium on the SPOT Earth Observation System*, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 151-168. In French.

A simulated SPOT image of the Paris basin on Sept. 30, 1980 was compared with an actual Landsat 2 image of the same scene. Three Landsat and SPOT spectral bands were investigated in terms of diazo prints and a numerical analysis of the spectral signature of each theme, relations between the luminances of two channels and cartography of each scene. The SPOT imagery displayed higher accuracy in delineating land uses, the state and types of vegetation and the types of bare ground. Improvements in radiometric precision were also projected for the SPOT, relative to Landsat capabilities. M.S.K.

A84-41187

MORPHOSEDIMENTOLOGICAL MAPPING USING SIMULATED SPOT DATA [CARTOGRAPHIE MORPHO-SEDIMENTOLOGIQUE A L'AIDE DE DONNEES SPOT SIMULEES]

J. TETREAU and G. ROCHON (Universite Laval, Sainte-Foy, Quebec, Canada) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 169-180. In French. refs

A84-41188

EXAMPLES OF NUMERICAL TREATMENTS [EXEMPLES DE TRAITEMENTS NUMERIQUES]

M. POUSSE, G. SAINT, and A. PODAIRE (Centre National d'Etudes Spatiales, Toulouse, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 185-190. In French.

A set of numerical procedures have been defined for optimizing simulated SPOT imagery. The image data are processed to enhance the resolution and the dynamic color display. SPOT 20 x 20 m pixels are decomposed into four 10 x 10 m pixel arrays and examined for the magnitude of correlations. An identical variance is assumed for all channels in order to perform calculations at a constant signal/noise ratio. Pairs of compared channel pixels are then compared with other pairs. Images are formed either by subtractive or additive synthesis, the latter involving a laser restituter generating an image directly from magnetic tape. Sample applications are provided for Landsat thematic mapper data for the Pyrenees and Marseille. M.S.K.

A84-41190

SPOT SIMULATIONS OVER THE LANDAISE FOREST [SIMULATIONS SPOT SUR LA FORET LANDAISE]

D. GUYON, J. RIOM, and G. SELLERON (Institut National de la Recherche Agronomique, Laboratoire d'Ecologie-Teledetection, Cestas, Gironde, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 205-211, 213. In French.

A84-41191

SPOT SATELLITE SIMULATION STUDY ON THE REGION OF BAGRE, UPPER VOLTA [ETUDE DE SIMULATION DU SATELLITE SPOT SUR LA REGION DE BAGRE(HAUTE VOLTA)]

M. DOSSO, G. SAVARY (IBM France, S.A., Centre Scientifique, Paris, France), and J. KILIAN (Institut de Recherches Agronomiques Tropicales et de Cultures Vivrieres, Paris, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 215-219. In French. refs

A84-41193

STUDY OF SIMULATED SPOT SATELLITE DATA ON THE FROMENTINE NARROWS AND SURROUNDINGS [ETUDE DES DONNEES SIMULEES DU SATELLITE SPOT SUR LE GOULET DE FROMENTINE ET SES ABORDS]

F. CUQU, V. MADEC, Y.-F. THOMAS, and R. ZBINDEN (Montrouge, Ecole Normale Supérieure, Montrouge, Hauts-de-Seine, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 239-257. In French. refs

A84-41194

AUTOMATIC PARCEL RECOGNITION - GEOMETRIC INTERPRETATION WITH SPOT [RECONNAISSANCE AUTOMATIQUE DU PARCELLAIRE - COMMENT FAIRE DE LA GEOMETRIE AVEC SPOT]

R. JEANSOULIN (Toulouse III, Université, Toulouse, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 259-274. In French.

An analysis of entity-by-entity treatment of digitized remote sensing data to extract geometric information from the scenes is presented. A procedure is defined which includes designation of an entity candidate by identification of an interior point, individualization of the entity by appurtenance criteria, the characterization of its limits and interpretation of the entity and its contents. Fuzzy sets theory is applied to designate the entity, which in agricultural applications will be a crop. Algorithms are defined for fuzzy multispectral segmentation, radiometric homogeneity, contours and connectivity. It is noted that a library of indexed, digitized reference overlays must be available for matching the entity-designate. Geometric representations are accumulated for all viewing dates to define an invariant, non-time dependent structure. M.S.K.

A84-41196

SIMULATION OF SPOT DATA ON THE LAKE OF FORET D'ORIENT [SIMULATION DES DONNEES SPOT SUR LE LAC DE LA FORET D'ORIENT]

P. CLERGEOT (Paris I, Université, Paris, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings . Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 287-292. In French.

A84-41952

ACQUISITION OF DIGITAL TOPOGRAPHIC DATA AND THE NEED FOR A STANDARDIZED DIGITAL DATA BASE

M. M. ALLAM (U.S. Department of Energy, Mines and Resources, Topographic Survey Div., Ottawa, Canada) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings . Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 1-12. refs

The design concepts of the National Digital Topographic Data Base developed in Canada for the exchange of digital topographic information among various users are discussed. Manual, semiautomatic, and automatic digitizing systems are discussed, and the advantages and requirements of computer-aided photogrammetric compilation are addressed. Methods of acquiring digital imagery are described, and the design of digital topographic

data bases is considered. Finally, national standards for the exchange of digital topographic data are discussed. C.D.

A84-41953* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A SAMPLING PROCEDURE TO GUIDE THE COLLECTION OF NARROW-BAND, HIGH-RESOLUTION SPATIALLY AND SPECTRALLY REPRESENTATIVE REFLECTANCE DATA

R. R. BRAND (Geographic Information Systems, Sterling, VA) and J. L. BARKER (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, MD) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 13-24. refs

A multistage sampling procedure using image processing, geographical information systems, and analytical photogrammetry is presented which can be used to guide the collection of representative, high-resolution spectra and discrete reflectance targets for future satellite sensors. The procedure is general and can be adapted to characterize areas as small as minor watersheds and as large as multistate regions. Beginning with a user-determined study area, successive reductions in size and spectral variation are performed using image analysis techniques on data from the Multispectral Scanner, orbital and simulated Thematic Mapper, low altitude photography synchronized with the simulator, and associated digital data. An integrated image-based geographical information system supports processing requirements. C.D.

A84-41956

LANDSAT 3 RBV IMAGERY FOR TOPOGRAPHIC MAPPING

L. U. BENDER and N. L. FALCONE (U.S. Geological Survey, Reston, VA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 45-54.

Cartographic research at the U.S. Geological Survey has included testing the use of RBV imagery in (1) map inspection and revision and (2) creation of a simple, low cost, mosaicked-image base map. At the scale of 1:100,000, it was found that unrectified RBV imagery can be successfully used to update cultural and natural features portrayed on topographic maps. It has also been found that the geometric fidelity of RBV imagery is sufficient to meet National Map Accuracy Standards. In a test of a mosaic comprised of four subscenes of Cape Cod, MA, a root mean square error of 33 meters was obtained when ground control was transferred to the subscenes from field-identified control on aerial photographs. Another test, of upper Chesapeake Bay, using control transferred from 1:24,000-scale topographic maps was made. Application of four linear transformations - the similarity, the affine, the perspective, and the projective - resulted in root mean square error values for single subscenes ranging from 100 meters to 30 meters. Author

A84-41958

DIGITIZATION OF RELIEF DATA AND EXPLOITATION OF DIGITAL TERRAIN MODELS AT I.G.N. (FRANCE)

A. BERNARD (Institut Geographique National, Saint-Mande, Val-de-Marne, France) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 65-73.

The production of digitized maps of France is discussed. Relief digitization methods are considered, including digitization based on 1:25,000 scale contours, using manual and automatic digitizers and their correction and revision procedures, and digitization based by stereo plotting of aerial photographs. Present applications of digitized relief at IGN, as well as those now under development, are reviewed. The use of data from the SPOT satellite for triangulation and calculation of digital terrain models is also discussed. C.D.

A84-41959

DIGITAL TECHNIQUES FOR THE INTEGRATION AND DISPLAY OF MULTISOURCE DATA

H. P. FOOTE, G. E. WUKELIC, and S. C. BLAIR (Pacific Northwest Laboratories, Richland, WA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 75-82. (Contract DE-AC06-77RL-01030)

The basic methodology involved in multisource data registration, integration, and display functions for processing and integrating remote sensing and geoscience data for energy-related applications is described. Methods which have been found to be the most useful for handling image and nonimage point-source, line, and numerical data formats are discussed in relation to raster vs. vector-polygon processing considerations. Types of multisource data products which have been generated by computer and utilized are enumerated. Options for digitally combining or overlaying various data bases on a common format to generate new user products are discussed and examples are presented, including a variety of display options. Basic hardware requirements are briefly described. C.D.

A84-41964

BEYOND ACCURACY ASSESSMENT - CORRECTION OF MISCLASSIFICATION

N. R. CHRISMAN (Wisconsin, University, Madison, WI) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 123-132. refs (Contract NSF SES-79-09370)

Existing remote sensing accuracy analysis techniques are reviewed and improvements are discussed. Attention is given to area classification, normal curve assumptions for defining confidence intervals and proportion-correct statistics. A sample critique is presented for a Landsat survey of wilderness areas that involved sampling rather than comprehensive scans. Data were evaluated in terms of percentage correct classification of forest species. It is noted that the cluster sampling method does not meet t distribution independence and normality assumptions. The kappa statistic is described for generating an index that expresses the agreement available if an independent process was

used as a classifier. Double sampling can be used and comprises correlations between a corrected small sample and a larger population. It is concluded that present statistical computational power makes Landsat data valid at the five (and not 10) class level
M.S.K.

A84-41972

REMOTE SENSING AND INTEGRATED RESOURCE SURVEY OF WESTERN SAUDI ARABIA

H. YOUNES, J. GRAINGER, M. ZAHARAN, and J. DOWNEY (King Abdul Aziz University, Jeddah, Saudi Arabia) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 205-211. refs

This contribution presents the preliminary results of an investigation into techniques for large scale resource survey in Saudi Arabia. A 5000 sq km pilot study area has been used to evaluate the potential of Landsat data for resource survey in xeric conditions. In the initial study, the performances of manually interpreted standard and enhanced Landsat imagery are compared against standard interpretations of large scale aerial photographs. Thematic resource maps at 1:100,000 and 1:250,000 scale were generated in combination with extensive ground survey. These will be used as controls to evaluate machine-classified products in a later phase of the project.
Author

A84-41980

ON A NEW CLASSIFICATION METHOD BY MULTI-DIMENSIONAL HISTOGRAM

Y. HABA, T. IIZUKA, and N. HAKADA (Kanazawa Institute of Technology, Kanazawa, Ishikawa, Japan) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 309-318.

An unsupervised classification method that uses the multi-dimensional histogram (MDH) table is described for accurate remotely sensed image correction. Multispectral scanner (MSS) data are treated in terms of their histogram space through comparisons with the MDH table. Boundaries between classes are identified as valleys in the MDH space. Numerical models are defined for the effective histogram space, quantization of the MSS data and the mean access time for using the MDH look-up tables. Procedures for cluster analysis are reviewed and a sample classification is made for a coastal region of Japan. The cluster analysis is fed statistical data from the entire scanned areas.
M.S.K.

A84-41982

COST MODELS FOR PHOTOGRAMMETRIC PROCESSES OEEPE RESEARCH TASK - PROGRESS REPORT

H. G. JERIE and E. W. HOLLAND (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 329-338.

The origin of the cost modelling research task of the European Organization for Experimental Photogrammetric Research (OEEPE) stems from the fact that little attention has been paid to the economic aspects of technological alternatives in the surveying

and mapping profession. The background and objectives of the research task are discussed and the present phased approach using an invited international working group is outlined. Current work on the stereo plotting and primary data acquisition phases is reported. Functional production processes and sub-processes covering technological alternatives have been determined, factors which influence production rates are identified and classified in a relation matrix according to effect on production rates. Cost models will be developed on one hand in terms of production rates and on the other in terms of cost standards. The models are being designed to link data from many different organizations using different production procedures and by combination the resulting data should be of maximum benefit to both individual organizations and to the profession as a whole.
Author

A84-41983

SOME PROBLEMS ASSOCIATED WITH LARGE AREA MAPPING FROM LANDSAT

R. WRIGHT and N. K. HUBBARD (Aberdeen, University, Aberdeen, Scotland) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 345-352. Sponsorship: Natural Environment Research Council. refs
(Contract NERC-GR/3/4170)

An image analyzer was employed to test the suitability of using Landsat imagery for land cover mapping of large areas of mainland Scotland. An automated approach was taken for analyzing imagery with five categories of land cover at scales of 1:500,000 or lower. Training areas were selected for examination with aerial photographs. The poor initial resolution beyond sample areas led to definition of an algorithm for the minimum distance to the mean. Landsat data were then compared with ground truth data and an 87.5 percent accuracy at the 95 percent confidence level was attained. Subdivision of each scene into subscenes allowed editing out persistent anomalies due to intense shadows caused by terrain relief.
M.S.K.

A84-41984

THE USE OF INTEGRATED MAPPING SYSTEMS IN ENVIRONMENTAL IMPACT ASSESSMENT AND LAND USE PLANNING

D. M. JOHNSTON (Harvard University, Cambridge, MA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 353-357.

A digital cartographic data base was developed for SW New Hampshire as an aid to land use planning. The 220 sq mile area had been mapped with field surveys and Landsat imagery and was decomposed into 51,000 cells, and a numerical terrain model, with interpolations at 300 m, was devised. The map was used to project potential changes due to expected rapid population growth, industrial and recreational development and extensive forestry. Three land use plans were then defined to ameliorate the projected environmental problems.
M.S.K.

A84-41985**CONSTRUCTION OF GROUND REFLECTANCE MAP FROM REMOTE SENSING DATA AND ITS APPLICATION TO TEMPORAL DATA ANALYSIS**

T. KUSAKA, Y. KAWATA, H. OKAZAKI, and S. UENO (Kanazawa Institute of Technology, Kanazawa, Ishikawa, Japan) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 359-371.

In the present study a method for estimating the optical thickness of the atmospheric haze from a Landsat data set is described. A method for converting the original CCT level data to the true ground albedo data with the aid of the Atmospheric Effect Correction System developed at Kanazawa Institute of Technology is given. It is also shown that the signature extension becomes possible by correcting the original Landsat data for the atmospheric effects and this approach will be a powerful tool in temporal data analysis. Finally, a processing system implementing the signature extension system is described. A new and powerful table look-up method in classification and a data base containing the statistical information on albedos for various ground classes with time are presented.

Author

A84-41987**FACTOR ANALYTIC TECHNIQUES FOR ENHANCEMENT OF TEMPORAL INFORMATION IN DIGITAL IMAGERY**

F. C. LUCE and B. J. TURNER (Pennsylvania State University, University Park, PA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 409-418. refs

Four digital analysis techniques for detecting land use changes in multitemporal aerial photographs to select a candidate procedure for further tests were evaluated. Photographs were digitized at 20 pixels/mm and were studied in terms of various resolutions in both black and white and color formats. The DoD ORSER software were employed for the analyses. A factor analysis (FA) technique was identified as most efficient and comprised principal components transformation and varimax, quartimax, equimax and oblimin rotations. Histograms were generated from the single, transformed contrasting channel data to guide density slicing efforts. Further studies are necessary to establish the practicality of using FA with MSS data.

M.S.K.

A84-41988**OBSERVATIONS AND TRENDS IN DIGITAL CARTOGRAPHY - 1982**

R. B. MCEWEN (U.S. Geological Survey, Reston, VA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 419-431.

The USGS National Mapping Division is undergoing a major transition from analog to digital cartography that will be more profound than the transition from planimetric methods to photogrammetry 40 years ago. This transition is taking place against a framework of inexorable trends in mapping, automated data processing, and digital cartography itself that strongly influence the course and rate of developments. Mapping costs increase, resources decrease, revision requirements increase, and custom

map requirements increase. ADP equipment and storage costs decrease, software costs increase, and Very Large System Integration (VLSI) capabilities soar. Meanwhile, map digitizing costs are still high, data base coverage has not achieved a critical mass, and automated cartographic and geographic information system applications are maturing so very slowly. Charting a course through these trends and conditions will be a major accomplishment for a large mapping organization.

Author

A84-41989**DATA BASE UPDATING BY DIGITAL MONO-PLOTTING**

B. MAKAROVIC (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 433-442. refs

A photogrammetric digitized approach to updating existing graphical and/or digital data bases is described. Digital monoplottting (DMP) can be used for updating old data bases or formatting new bases. Old data are divided into semantic and geometric components. Semantic changes are performed by isolating potential change areas, preprocessing new data for the areas, performing comparative analyses, interpreting and extracting relevant changes, marking, encoding and indexing the new data and verifying the completeness of the changed data. Rotations are defined for the geometric steps, as are control data and differential heights of new man-made objects. Similarity, spatial and merging transformations are then applied to the old data. DMP is modular and thereby more easily managed than orthophotographic techniques.

M.S.K.

A84-41993**REPRESENTING TOPOLOGIC PROPERTIES IN RASTER DATA STRUCTURES**

J. R. MULLER and R. P. OCONNOR (Synectics Corp., Rome, NY) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 473-482. refs
(Contract F30602-81-C-0279)

A major obstacle to satisfying the need for digital cartographic data has been the high cost and long lead time associated with data capture of cartographic source material. Dramatic improvements in the rate of data capture and in the processing of cartographic data are promised by the emergence of raster technology within the digital mapping arena. A major deterrent to the acceptance of raster data has been the inability to interact with cartographic entities as features and segments. This interaction can be improved by a raster data structure which expresses basic topologic properties. This paper defines the topologic properties of raster data, presents an encoding scheme for representing neighborhood connectivity, and examines techniques for interpreting other properties from the data. Finally, an example illustrates the enhancement of cartographic editing through this procedure.

Author

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

A84-41994

AUTOMATED MAPPING FROM LINEAR ARRAY SENSOR DATA

S. MURAI and R. SHIBASAKI (Tokyo, University, Tokyo, Japan)
IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 483-492.

An automated mapping technique is presented for use with linear array sensor data in a stereo mode. Attention is focused on the digital terrain model and Landsat MSS data. Ground control points were used to determine time dependent exterior orientation parameters. Fourier, maximum coefficient and minimum sum correlations were applied to the array data to obtain stereo imagery. A computer simulation devised to evaluate the technique accounted for the stereo angle and satellite orbit and altitude. The test area selected was mountainous terrain. Comparisons were made of 45 and 60 deg stereo angles. Accuracy to within one pixel rms was attained for height measurements using either angle. M.S.K.

A84-41998

EFFECTS OF RESAMPLING SCHEMES ON THE GROUND ALBEDO MAPPING OF LANDSAT MSS DATA

S. UENO (Kanazawa Institute of Technology, Kanazawa, Ishikawa, Japan) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 525-535. refs

Landsat MSS image data of a 300 sq km region of Japan were resampled three times and independently classified with or without deblurring. Eleven land use classes were defined after radiometric and geometric corrections were performed. The study examined three different bands and resampling effects on the gray level histograms and classification. A radiative transfer model was defined for the atmospheric effects on terrestrial albedo. A nearest neighbor assignment scheme best preserved original gray levels, mean surface albedos and their mean gray levels in bands 4, 5 and 6. Bilinear and cubic convolution resampled data exhibited the greatest divergences from original coastal zone and broad-leaved tree imagery. A quadratic discriminant classification method produced similar results for each resampling. M.S.K.

A84-43214

IDENTIFICATION OF LAND-USE PATTERNS ON MULTISPECTRAL REMOTE-SENSING IMAGES USING DIGITAL DATA PROCESSING [IDENTIFIKATSIYA STRUKTUR ZEMLEPOL'ZOVANIYA NA MNOGOZONAL'NYKH AEROKOSMICHESKIKH SNIMKAKH S POMOSHCH'YU TSIFROVOI OBRABOTKI DANNYKH]

I. SCHMIDT and H. STOYE (Deutsche Akademie der Wissenschaften, Institut fuer Geographie und Geoökologie, Leipzig, East Germany) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 89-96. In Russian. refs

The land-use patterns of part of the Leipzig region are interpreted by analyzing relationships between the brightnesses of multispectral images (obtained by Salyut-6 in August 1978) transformed into digital form. Interpretation results in the 640-680 and 790-890 nm bands are compared with land-use maps, and sufficiently good agreement is obtained. It is noted that the interpreted patterns can serve as the basis for further regional generalization. B.J.

A84-43216

THE USE OF THE SM-4-OMEGA SYSTEM FOR THE CONTROL AND PROCESSING OF DIGITAL TERRAIN DATA [ISPOL'ZOVANIE SISTEMY SM-4-'OMEGA' PRI KONTROLE I REDAKTIROVANII TSIFROVOI INFORMATSII O MESTNOSTI]

P. A. KALANTAIEV, E. G. MIKHALTSOV, V. P. PIATKIN, R. M. SALAVATOV, and V. G. CHUBUKOV (Akademiia Nauk SSSR, Vychislitel'nyi Tsentr, Novosibirsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1984, p. 106-114. In Russian. refs

A description is given of the SM-4-Omega system which is designed for interactive digital image processing. Attention is given to software developed for this complex, which is intended for the representation and processing of graphic information during the control and processing of digital terrain. A functional diagram of the Omega terminal is presented along with a brightness-interpolation pattern. B.J.

A84-44139

DIRECTIONAL REFLECTANCE PROPERTIES DETERMINED BY ANALYSIS OF AIRBORNE MULTISPECTRAL SCANNER DATA AND ATMOSPHERIC CORRECTION

W. OTT, B. PFEIFFER, and F. QUIEL (Karlsruhe, Universitaet, Karlsruhe, West Germany) Remote Sensing of Environment (ISSN 0034-4257), vol. 16, Aug. 1984, p. 47-54. Sponsorship: Deutsche Forschungsgemeinschaft. refs
(Contract DFG-AZ-HO-50/21)

The analysis of multispectral scanner data has shown a distinct dependence on scan angle, wavelength (0.4-1.1 micron), and classes (bare soil, vegetation) for directional reflectance properties of natural surfaces. Atmospheric effects have been computed by parameterization of the multiple scattered skylight through a model which permits a quick and adequate estimation of the airlight. Comparison of the scanner data with the corresponding model show that the differences between airborne and ground measurements are due to atmospheric effects. With the exception of short wavelengths and/or very low albedo, the object itself causes the directional variation in brightness. The hue shift of vegetation is produced mainly by the object, and modified by the atmosphere. An improvement of up to 20 percent is obtained when the directional reflectance properties in a direction-dependent classification procedure are taken into account. The multispectral data were collected with an 11-channel multispectral scanner over flat agricultural areas in the Rhine valley near Friburg (FRG) during the Airborne Remote Sensing Program, and in Straubing near Munich during the European CV-SAR-580 Experiment. J.P.

A84-45686

THE PROCESSING AND USE OF DATA FROM EARTH OBSERVATION SATELLITES

D. D. HARDY (Royal Aircraft Establishment, Remote Sensing Div., Farnborough, Hants., England) (Royal Society, Discussion on Technology in the 1990s: The Industrialization of Space, London, England, Dec. 7, 8, 1983) Royal Society (London), Philosophical Transactions, Series A (ISSN 0080-4614), vol. 312, no. 1519, July 26, 1984, p. 109-114; Discussion, p. 114.

A number of difficulties occur in connection with the utilization of advanced technology for practical applications. A real dilemma arises from the difficulty of defining the problem, and lack of communication between designer and user has led to the creation of white elephants. This dilemma is particularly acute in the case of earth observation from space. The present investigation has the objective to promote discussion by identifying a number of technical and institutional problems. Attention is given to aspects of data acquisition, problems and advances related to data processing, questions of analysis and interpretation, suitable approaches for the dissemination of the obtained results, and the solution of institutional problems. G.R.

A84-47337

DIGITAL PROCESSING OF MULTISPECTRAL IMAGE DATA FROM THE FRAGMENT MULTISPECTRAL SCANNING SYSTEM [TSIFROVAIA OBRABOTKA MNOGOZONAL'NOI VIDEOINFORMATSII S MSS 'FRAGMENT']

V. A. KRASIKOV and V. A. SHAMIS IN: Optoelectronic instruments in space experiments. Moscow, Izdatel'stvo Nauka, 1983, p. 107-118. In Russian.

The configuration and structure of the system for the digital processing of Fragment MSS images are described with emphasis on the base software and the principal stages of processing. Detailed consideration is given to image-data characteristics, radiometric correction, transformation to a given cartographic projection, the calculation of statistical characteristics, and thematically oriented brightness transformations. Examples and results of processing are presented. B.J.

A84-47355

REMOTE MICROWAVE THERMAL SENSING OF THE MOISTURE PROPERTIES OF DIFFERENT COVER TYPES OF THE EARTH'S SURFACE - PROBLEMS, SOLUTIONS, AND UTILIZATION IN THE NATIONAL ECONOMY [DISTANTSIONNOE OPREDELENIE VLAZHNOTNYKH SVOISTV ZEMNYKH POKROVOV RADIOTEPOLOKATSIONNYMI SREDSTVAMI - PROBLEMY, RESHENIYA, ISPOL'ZOVANIE V NARODNOM KHOZIAISTVE]

N. A. ARMAND and A. M. SHUTKO IN: Problems in present-day radio technology and electronics. Moscow, IRE AN SSSR, 1983, p. 140-157. In Russian. refs

A84-49029

COMPILATION OF LANDSCAPE MAPS OF DIFFERENT SCALE USING SPACE PHOTOGRAPHY DATA [SOSTAVLENIE RAZNOMASSHTABNYKH LANDSHAFTNYKH KART S ISPOL'ZOVANIEM KOSMICHESKOI FOTOINFORMATSII]

V. I. RIABCHIKOVA (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr 'Priroda', USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 39-45. In Russian. refs

A84-49036

EXPERIMENT CONCERNING THE ESTIMATION OF THE ACCURACY WITH WHICH LAND-USE CATEGORIES CAN BE DETERMINED ON SPACE SCANNER IMAGES [EKSPERIMENT PO OTSENKE TOCHNOSTI OPREDELENIYA KATEGORII ZEMEL' NA KOSMICHESKIKH SKANERNYKH SNIMKAKH]

R. I. ELMAN, E. V. BAKHTINOVA, A. N. POTAPOV, R. V. SVIRIDOVA, and L. A. BERSNEVA (Vsesoiuznoe Aerofototesoustroitel'noe Ob'edinenie Lesproekt, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 110-119. In Russian.

Consideration is given to the method and results of a computer experiment concerning the estimation of the accuracy with which land-use categories can be determined on space scanner images. The data examined were obtained with the Fragment multispectral scanner, and the experiment uses the SKANER program employing ASSEMBLER. The percentage of the correct recognition of test plots is taken as the accuracy estimation criterion of their selection. The experiment contains three series of tests: a comparison of two plot-recognition algorithms, estimation of the influence of the number of test plots, and estimation of the influence of fragment shift. The land-use category scheme obtained as the result of the experiment is presented. B.J.

A84-49099#

GROUND TEMPERATURES OBSERVED FROM SPACE [TEMPERATURE DEL SUOLO OSSERVATE DALLO SPAZIO]

B. BIZZARRI and P. PAGANO (Aeronautica Militare, Servizio Meteorologico, Rome, Italy) Rivista di Meteorologia Aeronautica (ISSN 0035-6328), vol. 43, Oct.-Dec. 1983, p. 247-263. In Italian.

A84-49137*# Purdue Univ., Lafayette, Ind.

LANDSAT-4 DATA QUALITY ANALYSIS

P. ANUTA, L. BARTOLUCCI, E. DEAN, F. LOZANO, E. MALARET, C. MCGILLEM, J. VALDES, and C. VALENZUELA (Purdue University, West Lafayette, IN) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 96-108.

(Contract NAS5-26859)

Landsat-4 satellite Thematic Mapper (TM) and multispectral scanner (MSS) data have been analyzed in order to ascertain data quality and information content. Geometric evaluations have tested band-to-band registration accuracy, and the TM's overall system resolution was evaluated for the case of image objects with high contrast, sharp edge responses. The information content evaluation employed clustering, principal components, and the transformed divergence separability measured on data from Iowa and Chicago, Illinois. The MSS classification analysis compared MSS and TM information contents for a large number of science classes. O.C.

A84-49139#

EVALUATION OF THEMATIC MAPPER DATA FOR NATURAL RESOURCE ASSESSMENT

R. H. HAAS and F. A. WALTZ (Technicolor Government Services, Inc., Moffett Field, CA) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 122-133. Sponsorship: U.S. Geological Survey. refs

(Contract USGS-14-08-0001-20129)

An assessment has been conducted of the Landsat Thematic Mapper (TM) data's utility in natural resource assessment, with emphasis on the manual interpretation and digital classification of the data for U.S. Department of the Interior applications. It is noted that substantially more information is derivable from TM data than from Multispectral Scanner (MSS) data. The improved spatial resolution of TM data also permitted more efficient visual interpretations of land use, better resource type identification, and improved assessment of the ecological status of natural vegetation. Results from analyses of both TM and TM Simulator spectral data suggest that the coefficient of variation for major land cover types is generally less for TM than MSS data taken from the same area. This reduction in variance could lead to improved multispectral classification of land cover types. O.C.

A84-49150#

INTEGRATION OF OBLIQUE SPACE IMAGERY INTO GEOGRAPHIC DATA BASES

A. BAUDOUIN (Institut Geographique National, Saint-Mande, Val-de-Marne, France) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 280-292. refs

The interest of oblique views from a satellite such as SPOT is described. Large areas can be covered with high quality images (without clouds) much faster than with the use of vertical views only. Some particular interesting areas can be surveyed very frequently with SPOT. In this case most of the images are oblique. Oblique views are also needed to detect stereopairs used for mapping purposes and to study radiometric properties of land cover (stereoradiometry). These oblique images have to be corrected. Geometric distortions can be removed using a digital terrain model, or can be evaluated from several images of the same area. For example, a D.T.M. can be computed from stereopairs. Rectified images can be compared to other images or other geographic data bases in order to get a better interpretation of the image and therefore a better up dating of these data bases. Author

A84-49154#

THE 1983 U.S. SPOT SIMULATION CAMPAIGN - PRODUCTION AND ASSESSMENT OF SIMULATED SPOT IMAGERY

G. M. WEILL (SPOT Image Corp., Washington, DC) and G. SAINT (Centre National d'Etudes Spatiales, Toulouse, France) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 328-338.

The data processing steps involved in producing simulated digital and photographic images from raw aerial scanner data for the SPOT simulation campaign are described. Several differences and similarities between the real and simulated sets of images are identified. It is found that in general, the simulated images are not identical to the recorded satellite data which are superior in planimetric accuracy. It is concluded that the simulated data provide the U.S. market with an adequate standard for testing the usefulness of SPOT data in many industrial applications. I.H.

N84-28874# Joint Publications Research Service, Arlington, Va. AUTOMATED SEARCH FOR CONTROL IMAGES ON PHOTOGRAPHS OF EARTH'S SURFACE USING SPECTRAL ANALYSIS Abstract Only

D. K. TKHABISIMOV In its USSR Rept.: Space (JPRS-USP-84-003) p 106 14 Jun. 1984 Transl. into ENGLISH from Issled. Zemli Kosmosa (USSR), no. 5, Sep.-Oct. 1983 p 93-99 Original language document announced as A84-14848 Avail: NTIS HC A07

The fast Fourier-Bessel transformation was used for the machine search for control images on space photographs of the Earth's surface. Shifts and turns on a plane were taken as the admissible transformations of the control images; the coherence function of fragments of the photograph is invariant with respect to these admissible transformations. The Laplace operator is used to increase the relative energy of the control images. The image processing was carried out on the SITRIM-80 special-purpose complex. Author (IAA)

N84-28876# Joint Publications Research Service, Arlington, Va. CRITERIA FOR EFFICIENCY OF EXPERIMENTS IN REMOTE SENSING Abstract Only

A. A. YAKOVLEV In its USSR Rept.: Space (JPRS-USP-84-003) p 107-108 14 Jun. 1984 Transl. into ENGLISH from Issled. Zemli Kosmosa (USSR), no. 5, Sep.-Oct. 1983 p 103-112 Avail: NTIS HC A07

The problems involved in solution of inverse problems in remote sensing and analysis of their information content are discussed. One of the most important tasks is optimization of remote measurements with selection of the best criteria for optimality of an experiment. Several possible approaches to determination of such criteria are examined. A Formulation of the problem is given and the problem of search for the best measurement plan is examined. Criteria for evaluating the quality of an experiment on the basis of the qualitative and quantitative makeup of the information obtained in an experiment are investigated. A numerical algorithm for optimization of a remote sensing experiment can be based solely on computation of the characteristics of the matrix of information of measurements $S(f)$. The tests, characterizing the value of a solution, is recommended as the principal criterion of the effectiveness of an experiment for problems in remote sensing of the environment. The applicability of this test is illustrated in a specific example. M.A.C.

N84-29297# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio.

REGISTRATION OF A LANDSAT IMAGE TO DTM (DIGITAL TERRAIN MATRIX): AN ERROR ANALYSIS

M. A. CROMBIE, J. A. SHINE, W. MOORE, and G. ALLTON Jan. 1984 53 p

(Contract DA PROJ. 4A7-62707-A-855)

(AD-A141766; ETL-0350) Avail: NTIS HC A04/MF A01 CSCL 12A

A mathematical model is postulated and tested that will enable a user to relate a digital LANDSAT image to a digital terrain matrix (DTM). The practicality of the procedure is examined and evaluated. One reason for registering a LANDSAT digital image to a DTM is to add another dimension to the signature used in scene classification. Ground elevation associated with a pixel can be converted to a terrain slope that, along with orientation with respect to the Sun, can be used as an additional component in a pattern recognition exercise. Pixel heights can also be used to restrict the pattern recognition scheme to test over the most likely subset of classes when scene classes can be organized by terrain heights a priori. The purpose of this report is to evaluate the accuracy with which the elevation assignments can be made when the registration process described herein is used. GRA

N84-29304# Research Inst. of National Defence, Stockholm (Sweden).

COMPUTER-AIDED MAPPING IN THE USA: EXPERIENCES FROM A STUDY TOUR IN NOVEMBER 1983

E. JUNGERT, T. POPOFF, and A. WELLVING Mar. 1984 40 p refs In SWEDISH; ENGLISH summary

(FOA-C-20533-D8; ISSN-0347-3694) Avail: NTIS HC A03/MF A01

Digital mapping techniques; mapping data bases; orophotography; map scanning; scanner-plotter systems; image processing; topography; hydrography; chart printing; data storage; photogrammetry; interactive graphic systems; digital terrain models; image processing languages and cooperation possibilities; and a computer vision laboratory for geographic information systems are discussed. Author (ESA)

N84-30368*# General Electric Co., Lanham, Md. Space Div. THEMATIC MAPPER IMAGE PROCESSING SYSTEM (TIPS) PROCESSING STATUS

J. BROOKS In NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 101-105 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 08B

Radiometric and geometric correction performance is considered. A one quantum level requirement was met in all spectral bands with an occasional band 7 exception. Initial post launch calibration was accomplished. An absolute radiometric calibration is in progress including an investigation of low impact solution to scan striping. Initial and three downstream updates as well as coordination with LANDSAT D' instrument calibration are planned. Methods and problems in measuring geometric correction performance are examined with an emphasis on temporal registration, geodetic registration, and the modeling error budget. Planned efforts include eliminating band 2, band 5 chips; continued performance monitoring; calibration of profile, misalignment angles, and filter parameters; studying the need for seasonal geodetic control points; and improvement of the subpixel correlation technique. A.R.H.

N84-30369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THEMATIC MAPPER IMAGE PRODUCTION IN THE ENGINEERING CHECKOUT PHASE

D. FISCHER and J. C. LYON (Systems and Applied Sciences Corp., Hyattsville, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 106-107 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 08B

Thematic Mapper data processing during LANDSAT 4's first year was performed on an engineering evaluation basis. Fully corrected products were created for some 282 scenes during this period using software and systems based upon the intended full production systems to become operational following the evaluation period. The engineering systems included substantial software and procedures for assessing spacecraft, instrument and ground processing algorithmic behavior. The data systems are described in terms of performance objectives, processing organization and data flow, quality assurance measurements and achievement of goals. The a priori implementation of TM radiometric and geometric corrections is described. Changes to processing suggested by or implemented on the basis of on-orbit data analysis are discussed. Spacecraft, instrument and algorithmic performance are evaluated. Author

N84-30370*# International Business Machines Corp., Palo Alto, Calif. Scientific Center.

LANDSAT-4 RADIOMETRIC AND GEOMETRIC CORRECTION AND IMAGE ENHANCEMENT RESULTS

R. BERNSTEIN and J. B. LOTSPIECH *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 108-115 Jul. 1984 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

Techniques were developed or improved to calibrate, enhance, and geometrically correct LANDSAT-4 satellite data. Statistical techniques to correct data radiometry were evaluated and were found to minimize striping and banding. Conventional techniques cause striping even with perfect calibration parameters. Intensity enhancement techniques were improved to display image data with large variation in intensity or brightness. Data were geometrically corrected to conform to a 1:100,000 map reference and image products produced with the map overlay. It is shown that these products can serve as accurate map products. A personal computer was experimentally used for digital image processing. Author

N84-30371*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TM DIGITAL IMAGE PRODUCTS FOR APPLICATIONS

J. L. BARKER, F. J. GUNTHER (Computer Sciences Corp., Silver Spring, Md.), R. B. ABRAMS (Computer Sciences Corp., Silver Spring, Md.), and D. L. BALL (Computer Sciences Corp., Silver Spring, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 116-126 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

LANDSAT-4 Thematic Mapper (TM) digital image products recorded onto computer compatible tapes (CCTs), which were available for internal research purposes prior to August, 1983, are reviewed. The SCROUNGE image processing system at Goddard Space Flight Center generated in tape formats: (1) raw band-sequential data (CCT-BT), generally used for internal transportation of digital data from one ground processing system to another; (2) calibrated data (CCT-AT), useful for researchers doing radiometric characterization; and (3) geometrically resampled data (CCT-PT), the final product. The formats represent different steps in the process of producing fully-corrected TM data. The CCT-BT images are re-sequenced from telemetry format to image format, but are uncorrected radiometrically and geometrically. The CCT-AT images had data from two faulty data channels replaced and all data radiometrically calibrated. The CCT-PT images were resampled by cubic convolution procedures to provide a

geometrically corrected image using satellite ephemeris and altitude data and scan-mirror correction data. The final product, the CCT-PT, is the one to which all of the radiometric and geometric corrections were applied. A.R.H.

N84-30374*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIVE RADIOMETRIC CALIBRATION OF LANDSAT TM REFLECTIVE BANDS

J. L. BARKER *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 140-180 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 14B

The characterization of the relative radiometric calibration of the protoflight Thematic Mapper sensor (TM/PF) is considered with focus on the variability and uncertainty of TM relative radiometry, including total variability as well as its systematic and random components. Emphasis is placed on identifying the magnitude and types of systematic errors, since these have the potential for being reduced during ground processing. Estimates of innate random variability, such as the standard deviation of a signal or its signal to noise ratio, are also important. The processing effects of radiometry are explored. Recommendations are given for engineering characterization, flight segment operations and ground processing. A.R.H.

N84-30375*# Rochester Inst. of Tech., N. Y.

EVALUATION OF THE RADIOMETRIC INTEGRITY OF LANDSAT-4 THEMATIC MAPPER BAND 6 DATA

J. R. SCHOTT *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 181-185 Jul. 1984 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 14B

An approach for experimentally evaluating the radiometric calibration of the LANDSAT-4 band 6 data is described which draws on a method used to radiometrically calibrate the HCMR data which involved underflying the satellite with an infrared line scanner. By extending this technology to higher altitudes experimental radiance data suitable for radiometric calibration of the TM band 6 sensor can be generated. Repetition of this experiment can permit evaluation of long term drift in the sensor and provide a data base for evaluating atmospheric propagation models for radiation transfer. To date, efforts were concentrated on modifying the infrared line scanner to match the spectral response of the TM band 6 sensor. In addition, the LOWTRAN code corresponding to a satellite overpass of September 1982 was run to yield a plot of transmission and path radiance as a function of altitude. A.R.H.

N84-30377*# Energy, Mines and Resources Canada, Ottawa (Ontario).

A PRELIMINARY ASSESSMENT OF LANDSAT-4 THEMATIC MAPPER DATA Abstract Only

D. G. GOODENOUGH, E. A. FLEMING, and K. DICKINSON *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 189 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

The results of a preliminary assessment of both raw and NASA processed Thematic Mapper (TM) data are discussed. Geometric correction of NASA processed TM data was carried out. Correction was possible to within 3 pixels in the along track direction and 2 pixels in the across track direction. A preliminary evaluation of TM imagery provided by the NASA LANDSAT Assessment System for geometric accuracy and map information content was performed on samples of imagery. The initial indications were that bands 3, 5 and 7 contain the most useful cartographic information. The resolution of rural and urban detail as well as the fit to plotted map detail was found to be improved over LANDSAT MSS, and such images may provide adequate revision information for 1:250,000 maps in areas where it is not currently profitable to use LANDSAT MSS. The relative gains and offsets for each detector in each band of raw data were calculated in a study of

the radiometric correction of TM data. This was done for different subscenes as well as a full scene and the variation of the results with direction of scan and position of subscene were studied.

Author

N84-30378*# Canada Centre for Remote Sensing, Ottawa (Ontario).

REVISED RADIOMETRIC CALIBRATION TECHNIQUE FOR LANDSAT-4 THEMATIC MAPPER DATA BY THE CANADA CENTRE FOR REMOTE SENSING

J. MURPHY, T. BUTLIN, P. DUFF, and A. FITZGERALD /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 190-198 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

A technique for the radiometric correction of LANDSAT-4 Thematic Mapper data was proposed by the Canada Center for Remote Sensing. Subsequent detailed observations of raw image data, raw radiometric calibration data and background measurements extracted from the raw data stream on High Density Tape highlighted major shortcomings in the proposed method which if left uncorrected, can cause severe radiometric striping in the output product. Results are presented which correlate measurements of the DC background with variations in both image data background and calibration samples. The effect on both raw data and on data corrected using the earlier proposed technique is explained, and the correction required for these factors as a function of individual scan line number for each detector is described. It is shown how the revised technique can be incorporated into an operational environment. A.R.H.

N84-30379*# European Space Agency. ESRIN, Frascati (Italy). **A PRELIMINARY ANALYSIS OF LANDSAT-4 THEMATIC MAPPER RADIOMETRIC PERFORMANCE**

C. JUSTICE, L. FUSCO, and W. MEHL (Joint Research Centre of the European Communities) /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 199 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 14B

Analysis was performed to characterize the radiometry of three Thematic Mapper (TM) digital products of a scene of Arkansas. The three digital products examined were the NASA raw (BT) product, the radiometrically corrected (AT) product and the radiometrically and geometrically corrected (PT) product. The frequency distribution of the digital data; the statistical correlation between the bands; and the variability between the detectors within a band were examined on a series of image subsets from the full scene. The results are presented from one 1024 x 1024 pixel subset of Reelfoot Lake, Tennessee which displayed a representative range of ground conditions and cover types occurring within the full frame image. Bands 1, 2 and 5 of the sample area are presented. The subsets were extracted from the three digital data products to cover the same geographic area. This analysis provides the first step towards a full appraisal of the TM radiometry being performed as part of the ESA/CEC contribution to the NASA/LIDQA program. Author

N84-30380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT-4 SCIENCE INVESTIGATIONS SUMMARY, INCLUDING DECEMBER 1983 WORKSHOP RESULTS, VOLUME 2

J. L. BARKER, ed. Jul. 1984 188 p refs Proc. of the LANDSAT-4 Early Results Symp., held in Greenbelt, Md., 22-24 Feb. 1983 and LANDSAT Sci. Characterization Workshop, held in Greenbelt, Md., 6 Dec. 1983 ERTS 2 Vol. (E84-10167; NASA-CP-2326-VOL-2; NAS 1.55:2326-VOL-2)

Avail: NTIS HC A09/MF A01 CSCL 08B

A series of brief summaries of the results of individual investigations of LANDSAT 4 image data characteristics are presented. Topics are divided into MSS and TM investigations, and applications of the imaging techniques. Radiometric and geometric accuracy are emphasized.

N84-30385*# Laboratoire de Meteorologie Dynamique, Paris (France).

CALIBRATION OF TM DATA FROM GROUND-BASED MEASUREMENTS

S. I. RASOOL and P. Y. DESCHAMPS (CNES, Toulouse) /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 21-22 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Methods of calibrating Thematic Mapper (TM) data by the use of ground based measurements are presented. Applications of the TM remote sensing data are discussed in addition to the ground truth measurement equipment and techniques. M.A.C.

N84-30389*# Geological Survey, Flagstaff, Ariz.

INTRABAND RADIOMETRIC PERFORMANCE OF THE LANDSAT-4 THEMATIC MAPPER

H. H. KIEFFER, E. M. ELIASON, and P. S. CHAVEZ, JR. /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 33-34 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

Radiometric characteristics of the LANDSAT 4 Thematic Mapper (TM) that can be established without absolute calibration of spectral data are examined. The analysis is based on radiometrically raw (B type) data of three daytime and two nighttime scenes. A set of 512 lines are examined on an individual detector basis. Subscenes selected for uniform-radiance are used to characterize subtle radiometric differences and noise problems. Virtually all nonideal performance is incorporated into the fully processed (P type) images, but disguised by the geometric resampling technique. M.A.C.

N84-30391*# European Space Agency. ESRIN, Frascati (Italy). **STATUS OF THE ESA-EARTHNET LANDSAT-4 TM GROUND PROCESSING CHAIN**

L. FUSCO /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 40-45 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

The European program of the European Space Agency received a mandate to upgrade the two existing LANDSAT stations operating in Europe, Kiruna in Sweden and Fucino in Italy, to acquire and process TM data. The salient features of the TM systems are summarized, and the preliminary results of the acceptance tests being carried out using the TM passes acquired in Fucino are reviewed before the X band downlink anomaly of LANDSAT-4. M.A.C.

N84-30392*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AN ANALYSIS LANDSAT-4 THEMATIC MAPPER GEOMETRIC PROPERTIES

R. E. WALKER, A. L. ZOBRIST, N. A. BRYANT, B. GOKHMAN, S. Z. FRIEDMAN, and T. L. LOGAN /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 46-49 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

LANDSAT Thematic Mapper P-data of Washington, D. C., Harrisburg, PA, and Salton Sea, CA are analyzed to determine magnitudes and causes of error in the geometric conformity of the data to known Earth surface geometry. Several tests of data geometry are performed. Intraband and interband correlation and registration are investigated, exclusive of map based ground truth. The magnitudes and statistical trends of pixel offsets between a single band's mirror scans (due to processing procedures) are computed, and the inter-band integrity of registration is analyzed. A line to line correlation analysis is included. M.A.C.

N84-30393*# Systems and Applied Sciences Corp., Hyattsville, Md.

THE USE OF LINEAR FEATURE DETECTION TO INVESTIGATE THEMATIC MAPPER DATA PERFORMANCE AND PROCESSING

C. M. GURNEY *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 50-52 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 08B

Geometric and radiometric characteristics of Thematic Mapper data are investigated through analysis of linear features in the data. A linear feature is defined as two close, parallel and opposite edges. Examples in remotely sensed data are such features as rivers and roads. The geometric and radiometric precision TM data is sufficient to allow accurate measurement of linear feature widths. Results also confirm a 28.5m ground IFOV as specified prior to launch. The increase dimensionality of the TM data as compared with MSS data allows the possibility of independent verification of results by using data from several bands. M.A.C.

N84-30394*# Purdue Univ., Lafayette, Ind.

SPATIAL RESOLUTION ESTIMATION OF LANDSAT-4 TM DATA Abstract Only

C. D. MCGILLEM, P. E. ANUTA, E. MALARET, and K. B. YU (Virginia Polytechnic Inst., Blacksburg) *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 53 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

Experiments to determine overall radiometric resolution are discussed. Scene structures, such as roads and field edges, are used with numerical estimation procedures to predict resolution in LANDSAT 4 Thematic Mapper imagery. A nominal resolution of 39 meters is determined rather than the predicted 30 meter prelaunch estimates. M.A.C.

N84-30395*# Research and Data Systems, Inc., Lanham, Md.

AN ANALYSIS OF THE HIGH FREQUENCY VIBRATIONS IN EARLY THEMATIC MAPPER SCENES

J. KOGUT and E. LARDUINAT *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 54 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 08B

The potential effects of high frequency vibrations on the final Thematic Mapper (TM) image are evaluated for 26 scenes. The angular displacements of the TM detectors from their nominal pointing directions as measured by the TM Angular Displacement Sensor (ADS) and the spacecraft Dry Rotor Inertial Reference Unit (DRIRU) give data on the along scan and cross scan high frequency vibrations present in each scan of a scene. These measurements are to find the maximum overlap and underlap between successive scans, and to analyze the spectrum of the high frequency vibrations acting on the detectors. The Fourier spectrum of the along scan and cross scan vibrations for each scene also evaluated. The spectra of the scenes examined indicate that the high frequency vibrations arise primarily from the motion of the TM and MSS mirrors, and that their amplitudes are well within expected ranges. M.A.C.

N84-30397*# Geological Survey, Flagstaff, Ariz.

TESTS OF LOW-FREQUENCY GEOMETRIC DISTORTIONS IN LANDSAT-4 IMAGES Abstract Only

R. M. BATSON and W. T. BORGESON *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 59 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

The geometric fidelity of the GSFC filmwriter used for Thematic Mapper (TM) images was assessed by measurement with accuracy better than three micrometers of a test grid. A set of 55 control points with known UTM coordinates was measured on a digital display of part of band 5 of the TM image of the Washington, D.C. area and fitted to the control points. The tests indicate that the geometric fidelity of TM images is likely to be higher than the ability of film recorders to reproduce the images. Author

N84-30398*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

INVESTIGATION OF TM BAND-TO-BAND REGISTRATION USING THE JSC REGISTRATION PROCESSOR

S. S. YAO and M. L. AMIS *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 60-61 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

The JSC registration processor performs scene-to-scene (or band-to-band) correlation based on edge images. The edge images are derived from a percentage of the edge pixels calculated from the raw scene data, excluding clouds and other extraneous data in the scene. Correlations are performed on patches (blocks) of the edge images, and the correlation peak location in each patch is estimated iteratively to fractional pixel location accuracy. Peak offset locations from all patches over the scene are then considered together, and a variety of tests are made to weed out outliers and other inconsistencies before a distortion model is assumed. Thus, the correlation peak offset locations in each patch indicate quantitatively how well the two TM bands register to each other over that patch of scene data. The average of these offsets indicate the overall accuracies of the band-to-band registration. The registration processor was also used to register one acquisition to another acquisition of multitemporal TM data acquired over the same ground track. Band 4 images from both acquisitions were correlated and an rms error of a fraction of a pixel was routinely obtained. A.R.H.

N84-30401*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIOMETRIC ACCURACY ASSESSMENT OF LANDSAT-4 MULTISPECTRAL SCANNER (MSS) DATA

W. L. ALFORD and M. L. IMHOFF *In* its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 69-72 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 08B

The LANDSAT-4 mission has unique characteristics relative to previous LANDSAT missions. The spacecraft is new; the orbit is lower with a more frequent repeat cycle; and the ground processing facility consists of new hardware with different algorithms being applied. How some of these changes affect the character of the radiometric data quality is explored. Banding effects; radiometric differences between LANDSAT 3 and 4; and the woodgrain pattern observed visually in the images are considered. Author

N84-30405*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.

LANDSAT SCENE-TO-SCENE REGISTRATION ACCURACY ASSESSMENT Abstract Only

J. E. ANDERSON *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 82 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

Initial results obtained from the registration of LANDSAT-4 data to LANDSAT-2 MSS data are documented and compared with results obtained from a LANDSAT-2 MSS-to-LANDSAT-2 scene-to-scene registration (using the same LANDSAT-2 MSS data as the base data set in both procedures). RMS errors calculated on the control points used in the establishment of scene-to-scene mapping equations are compared to error computed from independently chosen verification points. Models developed to estimate actual scene-to-scene registration accuracy based on the use of electrostatic plots are also presented. Analysis of results indicates a statistically significant difference in the RMS errors for the element contribution. Scan line errors were not significantly different. It appears that a modification to the LANDSAT-4 MSS scan mirror coefficients is required to correct the situation. A.R.H.

N84-30406*# Georgia Univ., Athens. Dept. of Geography.
GEOMETRIC ACCURACY OF LANDSAT-4 MSS IMAGE DATA
 R. WELCH and E. L. USERY /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 83-84 Jul. 1984 Previously announced as N83-27322 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

Analyses of the LANDSAT-4 MSS image data of North Georgia provided by the EDC in CTT-p formats reveal that errors of approximately + or - 30 m in the raw data can be reduced to about + or - 55 m based on rectification procedures involving the use of 20 to 30 well-distributed GCPs and 2nd or 3rd degree polynomial equations. Higher order polynomials do not appear to improve the rectification accuracy. A subscene area of 256 by 256 pixels was rectified with a 1st degree polynomial to yield an RMSE sub xy value of + or - 40 m, indicating that USGS 1:24,000 scale quadrangle-sized areas of LANDSAT-4 data can be fitted to a map base with relatively few control points and simple equations. The errors in the rectification process are caused by the spatial resolution of the MSS data, by errors in the maps and GCP digitizing process, and by displacements caused by terrain relief. Overall, due to the improved pointing and attitude control of the spacecraft, the geometric quality of the LANDSAT-4 MSS data appears much improved over that of LANDSAT-1, -2 AND -3. A.R.H.

N84-30407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOMETRIC ACCURACY ASSESSMENT OF LANDSAT-4 MULTISPECTRAL SCANNER (MSS)
 M. L. IMHOFF and W. L. ALFORD /in its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 85-86 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

Standard LANDSAT-4 MSS digital image data were analyzed for geometric accuracy using two P-format (UTM projection) images of the Washington, D.C. area, scene day 109 (ID number 4010915140) and scene day 125 (ID number 4012515144). Both scenes were tested for geodetic registration accuracy (scene-to-map), temporal registration accuracy (scene-to-scene), and band-to-band registration accuracy (within a scene). The combined RMS error for geodetic registration accuracy was 0.43 pixel (25.51 meters), well within specifications. The comparison between the 2 scenes was made on a band-by-band basis. The 90 percent error figure for temporal registration was 0.68 (57x57) pixel (38.8 meters). Although this figure is larger than the specification, it can be considered excellent with respect to user application. The best case registration errors between bands 1 and 2, and 3 and 4 were 14.2m and 13.7m, respectively, both within specifications. The worst case registration error was 38.0 m between bands 2 and 3. A.R.H.

N84-30408*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IMPACT OF LANDSAT MSS SENSOR DIFFERENCES ON CHANGE DETECTION ANALYSIS
 W. C. LIKENS and R. C. WRIGLEY /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 87-90 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 14B

Change detection techniques were used to pinpoint differences in the multispectral band scanners on LANDSAT 2, 3, and 4 satellites. The method of analysis was to co-register 512 by 512 pixel subwindows for all data pairs followed by scattergram generation and analysis. In all cases, the LANDSAT-4 data were used as the base to which other images were registered. There appear to be no major problems preventing use of LANDSAT-4 MSS with previous MSS sensors for change detection, provided the interference noise can be removed or minimized. This noise may result in detection of spurious changes, as well as affect other uses of the data, including image classification. Analysis of dark (water and forests), rather than light features will be most impacted because the noise will form a higher percentage of the total response at low DN values. Any data normalizations for

change detection should be based upon the data, rather than solely upon calibration information. While the observed relative radiometric transfer function between LANDSAT 3 and 4 was approximately as predicted, there were still significant deviations. Normalizing based upon data content also can have the advantage of allowing simultaneous normalization of the atmosphere as well as the radiometry. A.R.H.

N84-30409*# General Electric Co., Lanham, Md. Space Div.
LANDSAT-4 MSS GEOMETRIC CORRECTION: METHODS AND RESULTS
 J. BROOKS, E. KIMMER, and J. SU /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 91-92 Jul. 1984 ERTS
 Avail: NTIS HC A09/MF A01 CSCL 05B

An automated image registration system such as that developed for LANDSAT-4 can produce all of the information needed to verify and calibrate the software and to evaluate system performance. The on-line MSS archive generation process which upgrades systematic correction data to geodetic correction data is described as well as the control point library build subsystem which generates control point chips and support data for on-line upgrade of correction data. The system performance was evaluated for both temporal and geodetic registration. For temporal registration, 90% errors were computed to be .36 IFOV (instantaneous field of view) = 82.7 meters cross track, and .29 IFOV along track. Also, for actual production runs monitored, the 90% errors were .29 IFOV cross track and .25 IFOV along track. The system specification is .3 IFOV, 90% of the time, both cross and along track. For geodetic registration performance, the model bias was measured by designating control points in the geodetically corrected imagery. A.R.H.

N84-30410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPACT OF THEMATIC MAPPER SENSOR CHARACTERISTICS ON CLASSIFICATION ACCURACY
 D. L. WILLIAMS, J. R. IRONS, B. L. MARKHAM, R. F. NELSON, D. L. TOLL, R. S. LATTY (Maryland Univ., College Park), and M. L. STAUFFER (Computer Sciences Corp., Silver Spring, Md.) /in its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 93-97 Jul. 1984 refs ERTS
 Avail: NTIS HC A09/MF A01 CSCL 14B

A three factor (spectral, spatial, and radiometric resolution), two level (TM and MSS) analysis of variance (ANOVA) approach allowed evaluation of the effects of each factor individually and in all possible combinations. Digital classification accuracy was used as the figure of merit. Nine study sites in Washington, D.C. each of approximately 256 x 256 TM pixels, were randomly selected from the full scene for analysis. These results strongly suggest that the quantization level improvements and the addition of new spectral bands in the visible and middle IR regions (both afforded by the TM sensor design) can result in improved capabilities to accurately delineate land cover categories using a per point Gaussian maximum likelihood classifier. On the other hand, results indicate that the increase in spatial resolution to 30m does not significantly enhance classification accuracy. The spatial result points to an inherent limitation of a per point classifier and to the need to improve data analysis techniques to handle high spatial resolution data. A.R.H.

N84-30415*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRELIMINARY EVALUATION OF THEMATIC MAPPER IMAGE DATA QUALITY Abstract Only

R. B. MACDONALD, F. G. HALL, D. E. PITTS, R. M. BIZZELL, S. YAO, C. SORESENSEN, E. REYNA, and J. G. CARNES *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 113 Jul. 1984 Prepared in cooperation with Lockheed Engineering and Management Services Co., Inc., Houston, Tex. ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Thematic Mapper (TM) data from Mississippi County, Arkansas, and Webster County, Iowa, were examined for the purpose of evaluating the image data quality of the TM which was launched on board the LANDSAT-4 spacecraft. Preliminary clustering and principal component analysis indicates that the middle infrared and thermal infrared data of TM appear to add significant information over that of the near IR and visible bands of the multispectral scanner data. Moreover, the higher spatial resolution of TM appears to provide better definition of the edges and the within variability of agricultural fields. The geometric performance of TM data, without ground control correction, was found to exceed expectations. The modulation transfer function for the 1.65 m band was found to agree with prelaunch specifications when the effects of the GSFC cubic convolution and the atmosphere were removed. The band to band registration for the bands within the noncooled focal plane was found to be better than specified. However, the middle infrared and thermal infrared, which are on a separate cooled focal plane were found to be misregistered and were significantly worse than prelaunch specifications. M.G.

N84-30417*# Technische Univ., Munich (West Germany). Faculty for Geosciences.

A CONCEPT FOR THE PROCESSING AND DISPLAY OF THEMATIC MAPPER DATA

R. HAYDN *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 116-118 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

Multispectral information can best be accessed and evaluated through digital interactive image processing techniques. The potential user community, however, has not reached the level where image processing is being used routinely as a standard tool. Therefore, for the time being, special effort must be put into development of strategies that will guarantee optimal utilization of the spectral information contained in remote sensing data acquired under the varying conditions affecting each scene. The Thematic Mapper system provides spectral information in seven carefully selected spectral bands, covering the visible, near IR, short-wave IR and thermal IR region of the electromagnetic spectrum. The challenge is to devise the best approach for presenting this complex spectral information in a pictorial format which can be understood and accepted as a standard by the growing user community. M.G.

N84-30418*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

QUICK LOOK ANALYSIS OF TM DATA OF THE WASHINGTON, DISTRICT OF COLUMBIA AREA

D. L. WILLIAMS, J. R. IRONS, B. L. MARKHAM, R. S. LATTY (Maryland Univ., College Park), and M. L. STAUFFER (Computer Sciences Corp., Silver Spring, Md.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 119-120 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

A fixed factor analysis-of-variance (ANOVA) approach was used to quantify the impact of each TM sensor characteristic (spectral, spatial, and radiometric resolutions) on classification accuracy. All assessments were made relative to MSS sensor characteristics, and the impact of each characteristic was assessed individually, and in all possible combinations. Thematic Mapper data acquired over the Washington, D.C. area on November 2, 1982 were utilized to conduct the experiment. The following results were obtained:

the reduction of quantization level from eight bits to six bits caused a decrease in overall accuracy (7%); the use of only three bands (TM 2, 3 and 4) covering the visible and near infrared portion of the spectrum caused a decrease in overall accuracy (7%); and the decrease in spatial resolution resulted in an increase in overall accuracy (4%). Results indicate that the increased radiometric and spectral resolution of the TM instrument do provide increased information content. The result of the spatial resolution degradation is somewhat misleading, in that the result is more a function of spatial resolution. M.G.

N84-30510*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE EFFECT OF SPATIAL, SPECTRAL AND RADIOMETRIC FACTORS ON CLASSIFICATION ACCURACY USING THEMATIC MAPPER DATA

R. C. WRIGLEY, W. ACEVEDO (Technicolor Government Services, Inc.), D. ALEXANDER (Technicolor Government Services, Inc.), J. BUIS (Technicolor Government Services, Inc.), and D. CARD Jul. 1984 11 p refs

(NASA-TM-85995; A-9836; NAS 1.15:85995) Avail: NTIS HC A02/MF A01 CSCL 08B

An experiment of a factorial design was conducted to test the effects on classification accuracy of land cover types due to the improved spatial, spectral and radiometric characteristics of the Thematic Mapper (TM) in comparison to the Multispectral Scanner (MSS). High altitude aircraft scanner data from the Airborne Thematic Mapper instrument was acquired over central California in August, 1983 and used to simulate Thematic Mapper data as well as all combinations of the three characteristics for eight data sets in all. Results for the training sites (field center pixels) showed better classification accuracies for MSS spatial resolution, TM spectral bands and TM radiometry in order of importance.

Author

N84-30512# SACLANT ASW Research Center, La Spezia (Italy).

A DIRECTORY OF EUROPEAN, MIDDLE EASTERN, AND NORTH AFRICAN COASTAL GROUND CONTROL POINTS FOR MAPPING SATELLITE IMAGES

B. WANNAMAKER and E. NACINI 15 Mar. 1984 73 p (AD-A142019; SACLANTCEN-SM-170) Avail: NTIS HC A04/MF A01 CSCL 08B

Environmental data collected by satellite are now in extensive use. If the altitude and position of data-measuring satellites are accurately known, the measured data may be mapped automatically. Otherwise, as is usual, mapping on a standard projection may be achieved by using ground control points. For plotting oceanographic data from the eastern North Atlantic and the Mediterranean, SACLANTCEN has used the 392 European, Middle Eastern, and North African coastal ground control points whose positions and altitudes are listed in this document. GRA

N84-31238# Joint Publications Research Service, Arlington, Va. **AZERBAIJAN INSTITUTE DEVELOPS SUBSATELLITE MEASUREMENT SYSTEMS**

T. ISMAILOV *In its* USSR Rept.: Space (JPRS-USP-84-004) p 133-136 22 Aug. 1984 Transl. into ENGLISH from Pravda (Moscow), 27 Mar. 1984 p 3

Avail: NTIS HC A07

The subsatellite automatic data measuring system is used in aerial and satellite control-measurement areas. The system was designed for reception, preprocessing of data (in a search or operational mode) and the change from occasional to systematic measurements of various parameters of natural objects. Author

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

N84-31733*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE NEAR-EARTH MAGNETIC FIELD AT 1980 DETERMINED FROM MAGSAT DATA

R. A. LANGE and R. H. ESTES (Business and Technological Systems, Seabrook, Md.) Aug. 1984 61 p refs ERTS (E84-10170; NASA-TM-86133; NAS 1.15:86133) Avail: NTIS HC A04/MF A01 CSCL 05B

Data from the MAGSAT spacecraft for November 1979 through April 1980 and from 91 magnetic observatories for 1978 through 1982 are used to derive a spherical harmonic model of the Earth's main magnetic field and its secular variation. Constant coefficients are determined through degree and order 13 and secular variation coefficients through degree and order 10. The first degree external terms and corresponding induced internal terms are given as a function of Dst. Preliminary modeling using separate data sets at dawn and dusk local time showed that the dusk data contains a substantial field contribution from the equatorial electrojet current. The final data set is selected first from dawn data and then augmented by dusk data to achieve a good geographic data distribution for each of three time periods: (1) November/December, 1979; (2) January/February, 1980; (3) March/April, 1980. A correction for the effects of the equatorial electrojet is applied to the dusk data utilized. The solution included calculation of fixed biases, or anomalies, for the observation data. M.A.C.

N84-31737*# Rochester Inst. of Tech., N. Y. School of Photographic Arts and Sciences.

LANDSAT 4 BAND 6 DATA EVALUATION Quarterly Report

15 Jun. 1984 4 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS5-27323)

(E84-10175; NASA-CR-173854; NAS 1.26:173854; QR-7) Avail: NTIS HC A02/MF A01 CSCL 05B

A series of images of a portion of a TM frame of Lake Ontario are presented. The top left frame is the TM Band 6 image, the top right image is a conventional contrast stretched image. The bottom left image is a Band 5 to Band 3 ratio image. This image is used to generate a primitive land cover classification. Each land cover (Water, Urban, Forest, Agriculture) is assigned a Band 6 emissivity value. The ratio image is then combined with the Band 6 image and atmospheric propagation data to generate the bottom right image. This image represents a display of data whose digital count can be directly related to estimated surface temperature. The resolution appears higher because the process cell is the size of the TM shortwave pixels. M.A.C.

N84-31738*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

THE INPE HANDOUTS TO THE 6TH LANDSAT TECHNICAL WORKING GROUP (LTWG) MEETING

J. L. DEBARROSAGUIRRE, Principal Investigator, L. E. M. PARADA, and S. DEPAULAPEREIRA Jun. 1984 17 p Meeting held in Sao Jose dos Campos, Brazil, 12-15 Jun. 1984 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E84-10176; NASA-CR-173855; NAS 1.26:173855; INPE-3145-PRE/530) Avail: NTIS HC A02/MF A01 CSCL 05B

LANDSAT receiving and processing system in its present configuration and status are described, as well as the experience already obtained with LANDSATs 4 and 5. The revised table of station plans for TM reception and products and of implementation schedule for data formats employing superstructure conventions is updated. Standardization of the worldwide reference systems is proposed. The INPE preliminary TM products price list is included. A TM image received and processed is shown to illustrate the appearance of the products offered. B.G.

N84-31739*# California Univ., Santa Barbara. Remote Sensing Information Sciences Research Group.

ACTIVITIES OF THE REMOTE SENSING INFORMATION SCIENCES RESEARCH GROUP Final Report

J. E. ESTES, D. BOTKIN, D. PEUQUET, T. SMITH, and J. L. STAR, Principal Investigators 1 May 1984 138 p refs ERTS (Contract NAGW-455)

(E84-10177; NASA-CR-173856; NAS 1.26:173856) Avail: NTIS HC A07/MF A01 CSCL 05B

Topics on the analysis and processing of remotely sensed data in the areas of vegetation analysis and modelling, georeferenced information systems, machine assisted information extraction from image data, and artificial intelligence are investigated. Discussions on support field data and specific applications of the proposed technologies are also included.

N84-31742*# California Univ., Santa Barbara. Remote Sensing Research Unit.

ADVANCED DATA STRUCTURE AND GEOGRAPHIC INFORMATION SYSTEMS

D. PEUQUET, Principal Investigator *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 3 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

The current state of the art in specified areas of Geographic Information Systems GIS technology is examined. Study of the question of very large, efficient, heterogeneous spatial databases is required in order to explore the potential application of remotely sensed data for studying the long term habitability of the Earth. Research includes a review of spatial data structures and storage, development of operations required by GIS, and preparation of a testbed system to compare Vaster data structure with NASA's Topological Raster Structure. M.A.C.

N84-31743# California Univ., Santa Barbara. Dept. of Geography.

APPLYING ARTIFICIAL INTELLIGENCE TO LARGE NETWORKS

T. R. SMITH, J. L. STAR, Principal Investigators, and R. DUBAYAH *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 4 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 09B

The use of artificial intelligence to access and process geographically dispersed data sets with the use of geographically distributed software is examined. This requires capabilities in the areas of distributed data base management, long-haul networking, information presentation, distributed problem solving and artificial intelligence. In particular, the Pilot Land Data System, the Pilot Ocean Data System, and the Pilot Climate Data Base Management System (as well as a proposed Global Resource Information System) are structured as large computer networks. The techniques of artificial intelligence are discussed as they apply in distributed problem solving. M.A.C.

N84-31745*# California Univ., Santa Barbara. Remote Sensing Research Unit.

KNOWLEDGE BASED ENGINEERING FOR SPATIAL DATABASE MANAGEMENT AND USE

D. PEUQUET, Principal Investigator *In its* Activities of the Remote Sensing Inform. Sci. Res. Group 7 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

The use of artificial intelligence techniques that are applicable to Geographic Information Systems (GIS) are examined. Questions involving the performance and modification to the database structure, the definition of spectra in quadtree structures and their use in search heuristics, extension of the knowledge base, and learning algorithm concepts are investigated. M.A.C.

N84-31746*# California Univ., Santa Barbara. Remote Sensing Research Unit.

ANNOTATED BIBLIOGRAPHY OF GLOBAL RESOURCES INFORMATION SYSTEMS RELATED PUBLICATIONS

J. E. ESTES, J. L. STAR, Principal Investigators, M. J. COSENTINO, and L. J. MANN *In its Activities of the Remote Sensing Inform. Sci. Res. Group* 18 p 1 May 1984 ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

An annotated bibliography of work concerning geophysical data management systems is presented. Major topics under investigation include data acquisition, data storage, long term data preservation, architecture, preprocessing, hydrology, land resources, geology, meteorology, and applications of remote sensing techniques.

M.A.C.

N84-31747*# California Univ., Santa Barbara.

GLOBAL RESOURCES INFORMATION SYSTEM Final Report

J. E. ESTES, J. L. STAR, Principal Investigators, M. J. COSENTINO, and L. J. MANN *In its Activities of the Remote Sensing Inform. Sci. Res. Group* 30 p 1 May 1984 refs ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

The basic design criteria and operating characteristics of a Global Resources Information System GRIS are defined. Researchers are compiling background material and aiding JPL personnel in this project definition phase of GRIS. A bibliography of past studies and current work on large scale information systems is compiled. The material in this bibliography will be continuously updated throughout the lifetime of this grant. Project management, systems architecture, and user applications are also discussed.

M.A.C.

N84-31748*# California Univ., Santa Barbara.

THE POTENTIAL OF AI TECHNIQUES FOR REMOTE SENSING

J. E. ESTES, C. T. SAILER, Principal Investigators, and L. R. TINNEY (Edgerton, Germeshausen and Grier, Las Vegas, Nev.) *In its Activities of the Remote Sensing Inform. Sci. Res. Group* 34 p 1 May 1984 refs ERTS

Avail: NTIS HC A07/MF A01 CSCL 05B

The current status of artificial intelligence AI technology is discussed along with imagery data management, database interrogation, and decision making. Techniques adapted from the field of artificial intelligence (AI) have significant, wide ranging impacts upon computer-assisted remote sensing analysis. AI based techniques offer a powerful and fundamentally different approach to many remote sensing tasks. In addition to computer assisted analysis, AI techniques can also aid onboard spacecraft data processing and analysis and database access and query.

M.A.C.

N84-31749*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TM DIGITAL IMAGE PRODUCTS FOR APPLICATIONS

J. L. BARKER, F. J. GUNTHER, R. B. ABRAMS, and D. BALL 1984 4 p Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md. ERTS

(E84-10178; NASA-TM-85598; NAS 1.15:85598) Avail: NTIS HC A02/MF A01 CSCL 05B

Computer compatible tapes (CCTs) of LANDSAT 4 thematic mapper (TM) digital image products are compared and reviewed. The following tape formats are discussed: (1) raw band-sequential data (CCT-BT); (2) calibrated data (CCT-AT); and (3) geometrically resampled data (CCT-PT). Each format represents different steps in the process of producing fully corrected TM data. The CCT-BT images are uncorrected radiometrically or geometrically, CCT-AT data are radiometrically calibrated, and CCT-PT images are both radiometrically and geometrically corrected.

R.S.F.

N84-31753*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHARACTERIZATION OF RADIOMETRIC CALIBRATION OF LANDSAT-4 TM REFLECTIVE BANDS

J. L. BARKER, R. B. ABRAMS, D. L. BALL, and K. C. LEUNG 1984 103 p refs Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md. ERTS

(E84-10182; NASA-TM-85602; NAS 1.15:85602) Avail: NTIS HC A06/MF A01 CSCL 05B

Prelaunch and postlaunch internal calibrator, image, and background data is to characterize the radiometric performance of the LANDSAT-4 TM and to recommend improved procedures for radiometric calibration. All but two channels (band 2, channel 4; band 5, channel 3) behave normally. Gain changes relative to a postlaunch reference for channels within a band vary within 0.5 percent as a group. Instrument gain for channels in the cold focal plane oscillates. Noise in background and image data ranges from 0.5 to 1.7 counts. Average differences in forward and reverse image data indicate a need for separate calibration processing of forward and reverse scans. Precision is improved by increasing the pulse integration width from 31 to 41 minor frames, depending on the band.

M.A.C.

N84-31754*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TM DIGITAL IMAGE PRODUCTS FOR APPLICATIONS

J. L. BARKER, F. J. GUNTHER, R. B. ABRAMS, and D. BALL 1984 72 p refs Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E84-10183; NASA-TM-85620; NAS 1.15:85620) Avail: NTIS HC A04/MF A01 CSCL 05B

The image characteristics of digital data generated by LANDSAT 4 thematic mapper (TM) are discussed. Digital data from the TM resides in tape files at various stages of image processing. Within each image data file, the image lines are blocked by a factor of either 5 for a computer compatible tape CCT-BT, or 4 for a CCT-AT and CCT-PT; in each format, the image file has a different format. Nominal geometric corrections which provide proper geodetic relationships between different parts of the image are available only for the CCT-PT. It is concluded that detector 3 of band 5 on the TM does not respond; this channel of data needs replacement. The empty bin phenomenon in CCT-AT images results from integer truncations of mixed-mode arithmetic operations.

R.S.F.

N84-31757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIVE RADIOMETRIC CALIBRATION OF LANDSAT TM REFLECTIVE BANDS

J. L. BARKER 26 Apr. 1984 217 p refs ERTS

(E84-10186; NASA-TM-85623; NAS 1.15:85623) Avail: NTIS HC A10/MF A01 CSCL 05B

A common scientific methodology and terminology is outlined for characterizing the radiometry of both TM sensors. The magnitude of the most significant sources of radiometric variability are discussed and methods are recommended for achieving the exceptional potential inherent in the radiometric precision and accuracy of the TM sensors.

A.R.H.

N84-31758*# Centre National d'Etudes Spatiales, Toulouse (France).

INVESTIGATION OF LANDSAT 4 THEMATIC MAPPER GEOMETRIC PERFORMANCE: LINE TO LINE AND BAND TO BAND REGISTRATION

G. BEGNI, BOISSIN, M. J. DESACHY, and PERBOS Jul. 1984 26 p Sponsored by NASA ERTS

(E84-10187; NASA-CR-173882; NAS 1.26:173882) Avail: NTIS HC A03/MF A01 CSCL 05B

The geometric accuracy of LANDSAT TM raw data of Toulouse (France) raw data of Mississippi, and preprocessed data of Mississippi was examined using a CDC computer. Analog images were reconstituted on the VIZIR SEP device. The methods used for

line to line and band to band registration are based on automatic correlation techniques and are widely used in automated image to image registration at CNES. Causes of intraband and interband misregistration are identified and statistics are given for both line to line and band to band misregistration. A.R.H.

N84-31759*# Arizona Univ., Tucson.
LANDSAT-4 THEMATIC MAPPER MODULATION TRANSFER FUNCTION (MTF) EVALUATION Progress Report
 R. SCHOWENGERDT, Principal Investigator 14 Aug. 1984 12 p Sponsored by NASA ERTS
 (E84-10188; NASA-CR-173883; NAS 1.26:173883) Avail: NTIS HC A02/MF A01 CSCL 05B

Results of MTF analysis of imagery of the San Mateo Bridge are consistent on two TM image dates for bands 4,5, and 7. There are indications that bands 1, 2, and 3 suffer from low image contrast, and consequently low signal to noise in the derived MTFs. The two image analysis produced reasonable results along +45 deg and -45 deg azimuths in the 2-D MTF, but poor results along the 0 deg and 90 deg azimuths. The effective instantaneous field of view is given for each band, and the image contrast for water and the bridge are compared. Graphs show overall TM system MTFs. A.R.H.

N84-32892*# Arizona Univ., Tucson.
INVESTIGATION OF SEVERAL ASPECTS OF LANDSAT 4/5 DATA QUALITY Quarterly Progress Report
 R. C. WRIGLEY, Principal Investigator 20 Aug. 1984 4 p ERTS
 (Contract NCC2-234)
 (E84-10024; NASA-CR-173876; NAS 1.26:173876) Avail: NTIS HC A02/MF A01 CSCL 05B

A second quadrant from the Sacramento, CA scene 44/33 acquired by LANDSAT-4 was tested for band to band resolution. Results show that all measured misregistrations are within 0.03 pixels for similar band pairs. Two LANDSAT-5 scenes (one from Corpus Christi, TX and the other from Huntsville, AL) were also tested for band to band resolution. All measured misregistrations in the Texas scene are less than 0.03 pixels. The across scan misregistration Alabama scene is -0.66 pixels and thus needs correction. A 512 x 512 pixel area of the Pacific Ocean was corrected for the pixel offsets. Modulation transfer function analysis of the San Mateo Bridge using data from the San Francisco scene was accomplished. R.S.F.

N84-32893*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
LANDSAT-4 IMAGE DATA QUALITY ANALYSIS Quarterly Progress Report, 10 May - 9 Aug. 1984
 P. E. ANUTA, Principal Investigator 9 Aug. 1984 4 p ERTS
 (Contract NAS5-26859)
 (E84-10173; NASA-CR-173852; NAS 1.26:173852; LARS-CR-080984) Avail: NTIS HC A02/MF A01 CSCL 05B

Reformatting software to handle LANDSAT 5 data in quadrant format was completed and tested. The sensor two-dimensional point spread function was estimated from scene data. Budget recalculations are discussed. Two publications done under this contract are named. R.S.F.

N84-33852# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
QUALITY MEASURES FOR ESTIMATING THE PROPORTIONS OF DIFFERENT CLASSES WITHIN A SINGLE IMAGE RESOLUTION ELEMENT (PIXEL) [MEDIDADA DE QUALIDADE DE ESTIMADORES DE PROPORCOES DE CLASSES DENTRO DE UM PIXEL DE IMAGENS DE SATELITE]
 N. D. D. MASCARENHAS and V. R. M. CORREIA Jun. 1983 46 p refs In PORTUGUESE Presented at the 34th Reuniao Anual da Sociedade Brasileira para Progresso da Ciencia - Campinas, Julho, 1982
 (INPE-2791-PRE/354) Avail: NTIS HC A03/MF A01

Methods based on statistical regression models are proposed for estimating the proportion of different classes within a single

image resolution element, or pixel. The variance of the estimators depends on the geometry defined by the statistical average vectors of different land use classes. New measures related to the quality of that geometry are proposed that are based on the notions of angles defined by the geometry and on the condition number of the problem. Results concerning previously proposed quality measures, geometric angle, and variations of estimates with the condition number are presented. B.G.

N84-33871*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
LANDSAT-4 MSS AND THEMATIC MAPPER DATA QUALITY AND INFORMATION CONTENT ANALYSIS
 P. ANUTA, L. BARTOLUCCI, E. DEAN, F. LOZANO, E. MALARET, C. D. MCGILLEM, J. VALDES, and C. VALENZUELA In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 85-92 Aug. 1984 refs
 (Contract NAS5-26859)
 Avail: NTIS HC A24/MF A01 CSCL 05B

LANDSAT-4 thematic mapper (TM) and multispectral scanner (MSS) data were analyzed to obtain information on data quality and information content. Geometric evaluations were performed to test band-to-band registration accuracy. Thematic mapper overall system resolution was evaluated using scene objects which demonstrated sharp high contrast edge responses. Radiometric evaluation included detector relative calibration, effects of resampling, and coherent noise effects. Information content evaluation was carried out using clustering, principal components, transformed divergence separability measure, and supervised classifiers on test data. A detailed spectral class analysis (multispectral classification) was carried out to compare the information content of the MSS and TM for a large number of scene classes. A temperature-mapping experiment was carried out for a cooling pond to test the quality of thermal-band calibration. Overall TM data quality is very good. The MSS data are noisier than previous LANDSAT results. Author (ESA)

N84-33872*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECT OF SPATIAL, SPECTRAL AND RADIOMETRIC FACTORS ON CLASSIFICATION ACCURACY USING THEMATIC MAPPER DATA
 R. C. WRIGLEY, W. ACEVEDO (Technicolor Government Services, Inc.), D. ALEXANDER (Technicolor Government Services, Inc.), J. BUIS (Technicolor Government Services, Inc.), and D. CARD In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 93-100 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01 CSCL 05B

An experiment of a factorial design was conducted to test the effects on classification accuracy of land cover types due to the improved spatial, spectral and radiometric characteristics of the LANDSAT Thematic Mapper (TM) in comparison to the Multispectral Scanner (MSS). High altitude aircraft scanner data from the Airborne Thematic Mapper instrument was used to simulate TM data as well as all combinations of the three characteristics for eight data sets in all. Results for the training sites (field-center pixels) show better classification accuracies for MSS spatial resolution, TM spectral bands and TM radiometry in order of importance. Author (ESA)

N84-33873# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Kommunikationstechnik.
STRUCTURAL DESCRIPTION OF A LANDSAT THEMATIC MAPPER (TM) SCENE FOR IMPROVED REGION-BASED CLASSIFICATION
 G. GERIG and K. SEIDEL In ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 101-105 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

A region-based approach was tested on a LANDSAT Thematic Mapper subimage frame to investigate its ability to eliminate major drawbacks of standard multispectral classification. To overcome difficulties arising from low signal to noise ratio and the poor

dynamic range of videovalues within each spectral band, a multispectral edge-preserving smoothing algorithm was developed. A gradient-based segmentation partitions the smoothed image into homogeneous regions by grouping neighboring pixels with similar spectral properties, the basic intrinsic characteristics of which are collected in a property table. This structural description of the image serves as a starting point for knowledge-based interpretation in terms of land use categories. Author (ESA)

N84-33947*# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

ANALYSIS OF BISTATIC SAR SIGNATURES

E. S. KASISCHKE, R. W. LARSON, P. L. JACKSON, and B. A. BURNS *In* ESA IGARSS 84: Remote Sensing: From Res. towards Operational Use, Vol. 2 p 561-567 Aug. 1984 refs Sponsored by Internal Research and Development Funds Avail: NTIS HC A15/MF A01 CSCL 171

Bistatic SAR imagery was collected over urban and rural areas using a range of bistatic angles. The expected signatures of various targets within these areas under bistatic and monostatic imaging geometry are discussed in terms of basic imaging concepts. An analysis of the SAR imagery collected generally supports these expectations. Observed differences result primarily from surfaces having row structure and surfaces oriented so as to produce a specular return when imaged either monostatically or bistatically, but not both. Author (ESA)

N84-33958*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

SIMULATION OF SHUTTLE IMAGING RADAR (SIR)-B IMAGERY OVER FREIBURG TEST SITE

A. J. SIEBER, A. POPELLA, and P. HARTL (Stuttgart Univ.) *In* ESA IGARSS 84: Remote Sensing: From Res. towards Operational Use, Vol. 2 p 639-642 Aug. 1984 refs Avail: NTIS HC A15/MF A01 CSCL 171

The Shuttle Imaging Radar image simulator is described. The simulator consists of two programs. The first is an interactive program which checks input data validity. The second performs the image simulation. The first step is the computation of the received power as a function of the geometry and the backscatter behavior of the target. The simulation of the speckle and the system effects is done within a second step. The last step is the generation of a displayable image (8 bit). The input program creates a file which contains all the necessary data. This file is taken by the simulation program. Therefore it does not need any further data and performs the time intensive simulation entirely automatically. Inputs are a digital terrain model and a reflectivity ground truth file. Author (ESA)

N84-33996*# Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Cartographie Thematique.

A TEXTURAL IMAGE OF ALGIERS [UNE IMAGE TEXTURALE D'ALGER]

S. RIMBERT and A. SERRADJ *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 871-875 Aug. 1984 refs *In* FRENCH Avail: NTIS HC A15/MF A01 CSCL 05B

A geometrical operator (ETOILE) for processing LANDSAT images is presented. The operator exploits the fact that in urban areas lines are much closer and more complex. To distinguish town from countryside, the operator is sensitive to a high frequency of change in lineaments. It is used in a classic multidimensional classification scheme. The operator was used to map urbanisation of the area around Algiers. Author (ESA)

N84-35050# National Taiwan Univ., Taipei.

PRELIMINARY STUDY OF LANDSAT IMAGERIES OF TAIWAN AND ITS SURROUNDINGS Abstract Only

Y. A. FAN *In* National Science Council Sci. Res. Abstr. in Republic of China, 1983 p 56 Jun. 1984 Avail: Issuing Activity

A collection of LANDSAT imageries of Taiwan and its surroundings is presented. The coastal water depth is measured

using the LANDSAT 3 MSS imageries. Imagery interpretation methods and techniques include film density measurement. The LANDSAT coverage is divided into sub-regions for detailed investigation, using a color densitometer and a scanning microdensitometer. A Correlation analysis is performed. A grid system for density measurement of LANDSAT imageries for the seas around Taiwan is presented. Depth of coastal water in selected study areas down to 30 meters below sea level is determined. The coastal water depth profiles and sea state image interpretation are also described. M.A.C.

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A84-40118

SYMPOSIUM ON ADVANCES IN INSTRUMENTATION FOR PROCESSING AND ANALYSIS OF PHOTOGRAMMETRIC AND REMOTELY SENSED DATA, OTTAWA, CANADA, AUGUST 30-SEPTEMBER 3, 1982, PROCEEDINGS

Symposium sponsored by the International Society for Photogrammetry and Remote Sensing, Canadian Institute of Surveying, National Research Council of Canada, et al. Ottawa, Canadian Institute of Surveying (International Archives of Photogrammetry. Volume 24-11), 1982, 711 p.

Various topics on instrumentation for the analysis of photogrammetric and remotely sensed data are discussed. The general subjects addressed include: analytical and hybrid photogrammetric instruments; automated photogrammetric instruments and systems; instruments for analysis of remotely sensed data; instruments for preprocessing, storage, and dissemination of remotely sensed data; and equipment for processing synthetic aperture radar data. No individual items are abstracted in this volume C.D.

A84-40169*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RECENT ADVANCES AND FUTURE PROSPECTS FOR WEATHER, CLIMATE, AND OCEAN SPACE OBSERVATIONS

W. R. BANDEEN and D. ATLAS (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD) *IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 207-225. refs*

A84-40191#

SPOT SIMULATIONS IN BANGLADESH

J.-C. FAVARD (Centre National d'Etudes Spatiales, Toulouse, France) and M. U. CHAUDHURY (Space Research and Remote Sensing Organization, Dacca, Bangladesh) *IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 497-502.*

Preliminary results of an airborne simulation of the SPOT satellite remote-sensing equipment conducted over the Hail Haor depression in NE Bangladesh during January 1982, are reported. Daedalus-scanner (near-IR and visible) data and IR color photographs are obtained for the radiometric and geometric simulations, respectively, in overflights at 3500 or 7000 m. The geology, climate, hydrology, and land use of the test region are characterized, and a map is provided. Features identified on the simulated SPOT images include rafts on the lake, differences in aquatic vegetation and depth, winter-rice growing areas, tea plantations, and villages. T.K.

A84-40209#

DEVELOPMENT OF A METHODOLOGY TO LOCATE AND EVALUATE SUPERFICIAL THERMAL ANOMALIES USING AIRCRAFTBORNE MULTISPECTRAL SCANNERS

J. A. ESPEJO, M. C. FERNANDEZ-LUANGO (Empresa Nacional Adaro de Investigaciones Mineras, S.A., Spain), J. L. DIEZ (Madrid, Universidad Complutense, Madrid, Spain), M. KINDELAN, and A. GARCIA (IBM Scientific Centre, Madrid, Spain) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 715-721.

A methodology is presented for semiautomatically supplying information about the location, shape, dimensions and absolute and relative temperatures in areas with geothermal anomalies. The system uses an aircraft-borne M2S multispectral scanner mounted on a CASA 212 aircraft. The sensor collects data in 11 wavelength bands, including a thermal infrared band between 8 and 14 microns. The system was tested in the western half of Lanzarote Island in Spain where thermal anomalies were present. The results of the test indicate that the scanner data provided by the aircraft-borne system accurately represented the geothermal anomalies on the surface of the island. Using a catalog of anomalies, a map of thermal anomalies was drawn. I.H.

A84-40217#

THE INTEGRATION ON IMAGERY, ELEVATION MODELS AND POLYGON COORDINATE FILES THROUGH A COMMON MAP BASE

J. CLARK (Science Applications, Inc., Torrance, CA) (Environmental Research Institute of Michigan, NOAA, NASA, et al., International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983) IN: Papers selected for presentation at the Sixteenth International Symposium on Remote Sensing of Environment. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1984, p. 809-816. refs

The purpose of this study was the integration of remotely-sensed imagery and cartographic data by reprojecting them to match a common map base with a Universal Transverse Mercator projection. The three data types were: aircraft multispectral NS001 scanner imagery simulating the spectral channels of the Landsat-4 Thematic Mapper from visible to thermal infrared; Digital Land Mass Simulator (or Arc-Second) digital terrain models; and, land use polygon coordinate files created by the Environmental Sciences Research Institute. Each of the data types had inherent resolutions and projections that were changed somewhat during the reprojection process. Techniques included control point selection from imagery and reference maps; map base calculations based on the cataloging and manipulating of control points with the Image Based Information System (IBIS); and spatial and spectral rectifications of the imagery and cartographic data using algorithms of the VICAR (Video Image Communication and Retrieval) image processing system. The resultant data base, with reprojected imagery, elevation models and land use files are available (from the EROS Data Center, USGS, Sioux Falls) as data sets having an areal coverage corresponding to USGS 7 1/2-minute topographic quadrangles in the Los Angeles, California area.

Author

A84-40278

MAPPING FROM SPACE - THE METRIC CAMERA EXPERIMENT

G. KONECNY (Hannover, Universitaet, Hanover, West Germany), M. REYNOLDS (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands), and M. SCHROEDER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Optoelektronik, Wesseling, West Germany) Science (ISSN 0036-8075), vol. 225, July 13, 1984, p. 167-169.

The Spacelab metric camera experiment acquired stereoscopic high-resolution black-and-white and color infrared photographs of various regions of the world. In total, an area of about 11 million square kilometers was covered. Because of the delay in launching the Shuttle until November 28, illumination conditions were frequently poor over many candidate targets. However, unique

high-quality images with a ground resolution of about 20 meters were obtained by increasing camera exposure time. Initial image analysis has shown that these images may be used for earth mapping at the scale 1:100,000. Author

A84-40381

DIGITAL SLAR OF THE DFVLR - SYSTEM CONCEPT AND RESULTS [DIGITALES SLAR DER DFVLR - SYSTEMKONZEPT UND ERGEBNISSE]

F. WITTE (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) IN: Radar technology 1983; Symposium, 5th, Munich, West Germany, November 8-10, 1983, Reports. Duesseldorf, West Germany, Deutsche Gesellschaft fuer Ortung und Navigation, 1983, p. 8.1-8.18. In German.

A simple aircraft-borne Side-looking Airborne Radar (SLAR) with a real aperture is described. This instrument is the simplest image-forming microwave sensor which can be used to measure the differential back-scattering behavior of the earth's surface from an aircraft and to present the resulting images cartographically. The design and function of the SLAR are described, as are the antenna, transmitter and receiver units, its principle of digital data recording, its data conversion and reproduction, and its technical data and system parameters. C.D.

A84-40550

ATMOSPHERIC ATTENUATION AND SCATTERING DETERMINED FROM MULTHEIGHT MULTISPECTRAL SCANNER IMAGERY

M. D. STEVEN, J. B. MONCRIEFF (Nottingham, University, Loughborough, Leics., England), and P. M. MATHER (Nottingham, University, Nottingham, England) (Natural Environment Research Council and Remote Sensing Society Meeting on Airborne Thematic Mapper Simulation Campaign, Swindon, Wilts., England, May 11, 1983) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, July-Aug. 1984, p. 733-747. refs

Multispectral tests were conducted near Peterborough, Cambridgeshire, UK on Sept. 18, 1982. Data consisted of six 11-channel images from six altitudes ranging from 500 to 3000 m. The data available consisted of meteorological and radiation data and of ground spectral reflectivity. The temperature and dew point profiles indicated a stable atmosphere to 3000 m and above. On a sequence of overpasses from the highest altitude to the lowest, a decrease in solar irradiance was observed. At each altitude, digital readings were averaged over selected ground locations. Changes in altitude allowed the elimination of scattering by determining differences between areas and attenuation. The test results indicate that certain layers of the atmosphere may have unusually high attenuation and scattering and that at higher altitudes upward-scattered radiation can be several times more intense than the surface signal. J.P.

A84-41182

METHODS OF RADIOMETRIC SIMULATION AND THEIR REPRESENTATIVENESS [METHODES DE SIMULATION RADIOMETRIQUE ET LEUR REPRESENTATIVITE]

G. SAINT and A. PODAIRE (Centre National d'Etudes Spatiales, Toulouse, France) IN: Colloquium on the SPOT Earth Observation System, Montreal, Canada, May 12-14, 1982, Proceedings. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982, p. 101-110. In French. refs

The numerical model employed to predict the radiometric performance of the SPOT sensors is described. The model yields mean radiometric values, delineates the response in different spectral bands and simulates the geometric characteristics of the scene viewed. Previous remote sensing data have led to modeling upwelling spectral luminance curves on the bases of the 490, 520, 550, 610, 665, 750, 850 and 930 nm wavelengths. The model accounts for atmospheric absorption and reflectance variations between 850-930 nm. The sensor response is a linear function of the luminances at the eight reference wavelengths. Geometric

fidelity is assayed either by considering an aggregate of four pixels and simulated imagery with 10 m resolution on the ground track or by projecting the appropriate image deformations with respect to a map. Comparisons between two simulated actual images from the Landsat-D MSS results in correlation of 0.7-0.9. M.S.K.

A84-41963

THE ANALYTICAL STEREO PLOTTER - THE DATA GATHERER FOR COMPUTER ASSISTED CARTOGRAPHY AND INTEGRATED RESOURCE MAPPING

R. R. CHAMARD (Helava Associates, Inc., South Jordan, UT) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 115-121.

The features and use of an analytical stereoplotter (AS) as the front end of a computer assisted mapping system is outlined. The AS consists of a stereo viewer, microprocessor, minicomputer, operator station, printer output, software and plotting table. Cartography systems are applied for development projects, public hearing evidence, highway maps and strip maps. The procedures include definition of needs, researching available photographic data and acquiring new data if necessary, digitizing the maps and/or photographs and then editing the data. The total operating cost of an AS is estimated at \$36.94/hr for a \$125,000 machine and a 5-yr payback. M.S.K.

A84-41965

CANADIAN APPLICATIONS AND POTENTIAL BENEFITS OF SATELLITE MULTISPECTRAL IMAGE DATA

D. J. CLOUGH (Waterloo, University, Waterloo, Ontario, Canada), M. A. CLOUGH (Systems Engineering Associates, Ltd., Baden, Ontario, Canada), A. K. MCQUILLAN, and E. SHAW (Canada Centre for Remote Sensing, Ottawa, Canada) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 133-147. refs

Canadian activities in remote sensing satellite programs, particularly the development of a Radarsat mapping system, are reviewed. Canada has been receiving imagery from the Landsat series of spacecraft and Seasat, the latter having aided progress in SAR data analysis. The Radarsat Program was initiated in 1981 to provide sea ice monitoring capabilities primarily, and as secondary objectives monitor land use and map nonrenewable resources. Radarsat will carry an SAR and either a scatterometer or an electrically scanning multifrequency microwave radiometer. A launch window has been projected for the early 1990s and the necessity of providing crop monitoring capabilities in order to make the Radarsat economically viable has been noted. The SAR will have a ground resolution of 30 m. M.S.K.

A84-41996

COMPARISONS OF LANDSAT-4 WITH EARLIER LANDSATs

D. M. SMITH (General Electric Co., Lanham, MD) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 503-512.

The performance capabilities and instrumentation of Landsat-4 are compared with those of previous Landsat satellites. Landsat-4

carries the new Thematic Mapper as well as a multispectral scanner (MSS), the former furnishing 12 images/day and the latter, 200. The high throughput of MSS imagery is due in large part to upgraded and automated ground image processing facilities. MSS image framing and coverage, geometric correction accuracy and radiometric correction accuracy have been improved on the Landsat-4. The lower orbit, faster period of Landsat-4, compared to those of the three previous versions, will result in a slight rotation of similar images. M.S.K.

A84-41999

A MICROWAVE RADIOMETRIC IMAGERY OF THE TERRESTRIAL ENVIRONMENT

X. TENG (Chinese Academy of Sciences, Changchun Physics Institute, Changchun, People's Republic of China) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 537-545. refs

The results of airborne tests of the potential of microwave radiometric imagery (MICRAD) to furnish acceptable terrain features definition are reported. The Dicke-type radiometer, mounted on a helicopter, had a 100-300 K dynamic range, displayed digital imagery and gray level imagery and had a 1 K temperature sensitivity. The distribution regularity of the radiometric field is reviewed with attention given to water bodies, marshland, soil, vegetation and coastal zone sources. Comparisons with ground truth demonstrate MICRAD sensitivity to different types of vegetation, coastal topography, average soil moisture content and the presence of an oil slick in the sea. M.S.K.

A84-43306* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

STRATOSPHERIC SPECIES MEASUREMENTS WITH TUNABLE DIODE LASER ABSORPTION SPECTROSCOPY

R. T. MENZIES and C. R. WEBSTER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Tunable diode laser development and spectroscopy applications; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1983. Bellingham, WA, SPIE The International Society for Optical Engineering, 1983, p. 105-109. (Contract NAS7-100)

A balloon-borne instrument for stratospheric research has been developed with the capability to simultaneously measure several chemically related species in situ, for a full diurnal cycle. The instrument utilizes tunable infrared diode lasers (TDLs) to provide the radiation in selected wavelength regions for sensitive absorption spectroscopy over a one-km round-trip path. The TDL radiation is directed to a remote retroreflector which is lowered 500 m below the instrument gondola. A HeNe laser and co-aligned TV camera with CID imaging are used for retroreflector tracking. Currently the instrument operates with two TDLs, and the capability exists to measure four stratospheric species: NO, NO₂, O₃, and H₂O. The number of operating TDLs can be expanded to four, resulting in the possibility of measuring several additional trace species.

Author

A84-44537#

LAND SURFACE TEMPERATURE MEASUREMENTS FROM THE SPLIT WINDOW CHANNELS OF THE NOAA 7 ADVANCED VERY HIGH RESOLUTION RADIOMETER

J. C. PRICE (U.S. Department of Agriculture, Hydrology Laboratory, Beltsville, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Aug. 20, 1984, p. 7231-7237. refs

The Advanced Very High Resolution Radiometer on the NOAA 7 satellite acquires 1-km spatial resolution data in 'split window' channels at 10.8 and 11.9 microns. Data from these spectral channels may be used to estimate surface temperature and the atmospheric correction to radiation from the earth's surface.

Analysis of a data set from July 1981 shows that (1) there is satisfactory agreement between the equation resulting from radiative transfer theory and the atmospheric correction algorithm as obtained by analysis of an area of incipient cloud street formation; (2) agreement is also satisfactory between this algorithm and the statistically derived NOAA algorithm used to obtain sea surface temperatures from the satellite data; (3) in areas of cloud street formation, variations of atmospheric moisture produce radiance temperature differences of order 2-3 C, which if neglected would cause errors in the derivation of surface thermal characteristics. Author

A84-44922

DPS - A DIGITAL PHOTOGRAMMETRIC SYSTEM FOR PRODUCING DIGITAL ELEVATION MODELS AND ORTHOPHOTOS BY MEANS OF LINEAR ARRAY SCANNER IMAGERY

O. HOFMANN, P. NAVE (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany), and H. EBNER (Muenchen, Technische Universitaet, Munich, West Germany) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Aug. 1984, p. 1135-1142. refs

A new digital procedure for generating and processing scanner images is presented. The terrain is scanned by an opto-electronic three-line scan camera from aircraft, missiles, or spacecraft. Three linear sensor arrays are arranged in the focal plane of the camera objective perpendicular to the flight course. Each sensor array produces an image strip of the covered terrain according to the push broom principle. Points in the digital elevation model (DEM) to be computed are selected in the middle image strip whose object planes are nearly vertical. The corresponding image points in the other two image strips are determined by area correlation methods. The coordinates of all these image points and a few control points are inserted into a least-squares adjustment for computing the orientation parameters of the camera along its entire flight course and the coordinates of the points of the DEM. Raster plots of orthophotos and stereo orthophotos are produced after the digital rectification of the image strips, utilizing the points of the DEM grid. Author

A84-45132

NEW SYSTEMS FOR REMOTE SENSING OF EARTH FROM SPACE [NEUE ANLAGEN FUER DIE FERNERKUNDUNG DER ERDE AUS DEM WELTRAUM]

W. BERGHOFER, G. SUESSENGUTH, and R. MARTIN (Messerschmitt-Boelkow-Blohm GmbH, Munich, West Germany) Frequenz (ISSN 0016-1136), vol. 38, July-Aug. 1984, p. 159-161. In German.

A new processing station for the Landsat Thematic Mapper is discussed, and other remote sensing stations being brought into use are briefly described. A block diagram of the new processing station is presented, and the hardware characteristics of the installation are given. Technical data are shown for a new tracking antenna. C.D.

A84-45685

ERS-1 - ITS PAYLOAD AND POTENTIAL

S. P. ANSON (Marconi Space and Defence Systems, Ltd., Portsmouth, Hants., England) (Royal Society, Discussion on Technology in the 1990s: The Industrialization of Space, London, England, Dec. 7, 8, 1983) Royal Society (London), Philosophical Transactions, Series A (ISSN 0080-4614), vol. 312, no. 1519, July 26, 1984, p. 103-108.

The European Remote Sensing Satellite Number 1 (ERS-1) has the objective to conduct measurements from which specific products can be made available at sufficient speed to be useful. The major products are related to global coverage of surface winds, global coverage of sea wave spectra, limited coverage of ocean and land surface imaging, global sea and ice surface structure, and global sea surface temperature. The considered objectives require full earth coverage on a regular basis. In order to satisfy these requirements, it is necessary to select a near polar orbit. A description is presented of the measuring instruments

employed to collect the needed data, taking into account an active microwave instrument, the radar altimeter, an along track scanning radiometer (ATSR), and a microwave sounder. Attention is also given to aspects of data transmission, the potential of the ERS-1, and the industrialization of ERS-1. G.R.

A84-47327

EXPERIMENTAL INFORMATION-MEASURING COMPLEX FOR THE OPERATIONAL MONITORING OF EARTH RESOURCES - DEVELOPMENT RESULTS [EKSPERIMENTAL'NYI INFORMATSIONNO-IZMERITEL'NYI KOMPLEKS OPERATIVNOGO IZUCHENIIA PRIRODNYKH RESURSOV ZEMLI - ITOGI RAZRABOTKI]

G. A. AVANESOV, V. M. BALEBANOV, I. A. L. ZIMAN, S. A. IGNATENKO, T. I. KURMANALIEV, V. M. MURAVEV, E. I. ROZHAVSKII, A. G. SYCHEV, and V. I. TARNOPOLSKII IN: Optoelectronic instruments in space experiments. Moscow, Izdatel'stvo Nauka, 1983, p. 5-29. In Russian. refs

The structure and functions of the main units of an experimental information-measuring complex based on the satellite-borne Fragment multispectral scanner system are described, and illustrated by a number of diagrams. The principal parameters of the Fragment system are examined, and attention is given to aspects of metrological support for the measurement of earth-surface brightness by multispectral scanning instrumentation. B.J.

A84-48048

REMOTE SENSING OF EARTH RESOURCES BY THE SALYUT-6 ORBITAL STATION IN THE FRAMEWORK OF THE INTERCOSMOS PROGRAM [ISSLEDOVANIE PRIRODNYKH RESURSOV ZEMLI NA ORBITAL'NOI STANTSII 'SALIUT-6' PO PROGRAMME 'INTERKOSMOS']

IU. P. KIENKO Geodeziia i Kartografiia (ISSN 0016-7126), July 1984, p. 1-8. In Russian.

The design and main results of the Salyut-6 remote sensing program are described. It is noted that the Salyut-6 program represents the first time a systems approach was used to develop a wide-scope program for the sensing of earth resources from a manned orbital station. A large volume of complex photographic and visual data was obtained on the natural resources of land and water bodies; methods of preflight planning were developed; and international subsatellite experiments were carried out for the first time. L.M.

A84-49032

STANDARDIZATION OF THE SENSITIVITY OF RADIOMETRIC DEVICES FOR THE REMOTE SENSING OF EARTH RESOURCES [NORMIROVANIE CHUVSTVITEL'NOSTI RADIOMETRICHESKOI APPARATURY DLIA ISSLEDOVANIIA PRIRODNYKH RESURSOV ZEMLI]

G. K. KHOLOPOV, R. SH. KHISAMOV, and F. G. KHUZIN Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 81-88. In Russian. refs

A84-49034

EFFICIENCY OF THE CALIBRATION OF SATELLITE-BORNE MULTICHANNEL MICROWAVE RADIOMETER SYSTEMS BY MEANS OF REFERENCE ZONES IN THE OCEAN [EFFEKTIVNOST' KALIBROVKI SPUTNIKOVYKH MNOGOKANAL'NYKH SVCH RADIOMETRICHESKIKH SISTEM S POMOSHCH'IU REPERNYKH OBLASTEI V OKEANE]

A. G. GRANKOV and A. M. SHUTKO (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1984, p. 95-102. In Russian. refs

The paper presents results of a theoretical study of the efficiency of the calibration of satellite radiometer data by means of reference zones in the ocean; the microwave radiometer data for these zones are fixed to values of geophysical parameters known from contact (ship or aerial) measurements. Conditions are established under which the accuracy of remote measurements, obtained along

the satellite trajectory, is close to the accuracy of contact measurements in the reference zones. B.J.

A84-49134* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT-4 SENSOR PERFORMANCE

J. L. BARKER (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, MD) and F. J. GUNTHER (Computer Sciences Corp., Earth Observations Systems Dept., Silver Spring, MD) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 46-74. Previously announced in STAR as N84-14573. refs

Preflight and in-orbit sensor and data measurements indicate that TM meets or exceeds most specifications. Measured spectral band edges meet instrument specifications in 12 out of 14 cases; there is ample dynamic range. The signal-to-noise ratio exceeds specifications, except for band 3, channel 4; and band 7 channel 7 is very noisy but still meets specifications. The modulation transfer function of channel 4, band 2, is smaller than specified. Registration errors between the primary focal plane (PFP) and the cold focal plane (CFP) are about 0.75 pixels along-scan and 0.2 pixels across scan. Forward and reverse scan discontinuities are well within ground-processing capabilities to rectify. Instrument gain variability, up to 7 percent for band 5, requires use of the internal calibration (IC) system to assure radiometric accuracy. Preliminary applications evaluation of image contents indicates that TM provides much better definition of edges than MSS. A.R.H.

A84-49155* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STUDIES OF OPTICAL AND BIOLOGICAL PROPERTIES OF TERRESTRIAL LAND COVER USING MULTISPECTRAL LINEAR ARRAY TECHNOLOGY

W. L. BARNES and V. V. SALOMONSON (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, MD) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 340-354.

A series of experiments to study the optical and biological properties of terrestrial land cover are planned for late 1987 using a six-channel imaging spectroradiometer based on newly developed multispectral linear array (MLA) detector technology. Data from selected portions of the Sahel and rain forests of Africa and South America will be used to delineate biomass classes and estimate spherical albedos. A spatial resolution of 15 meters in the four visible-near IR channels and 30 meters in two shortwave IR channels, including a 'new' channel centered at 1.24 micrometers when combined with a spectral width of 20 nm for all channels, will be used to investigate possible improvements in land cover classification. Technology demonstrations include a test of data compression on data quality, the first spaceborne utilization of short wave infrared Schottky barrier Pd2Si detector arrays, and the use of close-butted, multi-array modules with attached spectral filters. Author

A84-49316

OPTOELECTRONIC SYSTEMS IN STUDIES OF NATURAL RESOURCES [OPTIKO-ELEKTRONNYE SISTEMY V ISSLEDOVANIYAKH PRIRODNYKH RESURSOV]

A. S. ELIZARENKO, V. A. SOLOMATIN, and I. U. G. IAKUSHENKOV Moscow, Izdatel'stvo Nedra, 1984, 216 p. In Russian. refs

This book is concerned with optoelectronic systems (OES) designed for obtaining information regarding the optical properties of natural objects on phenomena on the basis of remote sensing. Attention is given to systems for the study of earth resources, although the discussed principles could be also employed in the case of OES intended for studies involving other planets or celestial bodies. General information is presented, and signals in optoelectronic systems are discussed, taking into account the characteristics and operation of OES, the role of OES in the study

of natural resources and the surrounding medium, a classification of OES used in the study of natural resources, and qualitative criteria regarding these OES. The laws of optical emission which are utilized in the design of OES are considered along with the passage of electromagnetic radiation in the optical range through the atmosphere, the components and the materials used in optical systems, the modulation of the signal in OES, the separation of the signal from the noise background, the electronic subsystem of the OES, the calculation of the basic parameters of the OES, and television and IR imaging systems. G.R.

N84-29284# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

CONTRIBUTIONS TO IMAGING QUALITY AND HEIGHTING ACCURACY OF AERIAL CAMERAS USED AT FAIRLY HIGH ALTITUDES

J. SIEVERS and K. SCHUERER In its Repts. on Cartography and Geodesy. Ser. 2: Translations, No. 40 p 119-139 1983 refs Presented at ISPRS Commission I, Canberra, Australia, Apr. 1982

Avail: NTIS HC A08/MF A01

The determination of image quality for imagery obtained in photo missions at flying heights of 6 to 14 km with 4 cameras of different focal length is considered. Resolving power determined with a tri-bar test target serves as quality criterion. The aerial film material AGFA Aviphot Pan 200 was used. A method to estimate heighting accuracy is derived. The influence of image quality in this model is discussed. Author (ESA)

N84-29305# Research Inst. of National Defence, Linköping (Sweden).

PROCEEDINGS OF THE CONFERENCE ON MICROWAVE SIGNATURES IN REMOTE SENSING

J. ASKNE, H. HELLSTEN, and B. SVENSSON Mar. 1984 41 p In SWEDISH; ENGLISH summary Proc. held at Toulouse, 16-20 Jan. 1984

(FOA-C-30359-E1,E3; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm KR 50

Developments in the applications of microwaves to remote sensing were reported. Polarization effects in sea ice signatures; microwave scattering from sea water waves; stepped frequency microwave radiometer measurements in hurricanes; backscattering properties of high mountain areas; the prediction of root soil moisture with a water balance microwave model; microwave features of vegetation, measures of the sources of scatter from vegetation; theoretical scattering models; and determination of dielectric properties of different materials are discussed.

Author (ESA)

N84-29381# Nova Univ., Dania, Fla. Oceanographic Center.

FIRST- AND SECOND-ORDER GRAVITY FIELD SOLUTIONS BASED ON SATELLITE ALTIMETRY

G. BLAHA Jan. 1984 113 p

(Contract F19628-82-K-0007)

(AD-A142256; AFGL-TR-84-0083; SR-2) Avail: NTIS HC A06/MF A01 CSCL 08E

The increasing accuracy of satellite altimetry and its growing use in the determination of the general circulation of the oceans provide the motivation for conceiving the most rigorous model possible in relating the pressure and geopotential gradients. In response to such a need, the standard derivation is refined through the inclusion of second-order effects. This refinement is carried out with extensive use of tensor notations. Since altimeter measurements are directly affected by the surface (geocentric) tide, an exact representation of the latter is important. An improvement of the altimeter model with tidal effects included is achieved by an adaptation of Schwiderski's formula giving the ocean bottom deformation due to ocean tidal loading. The resulting model for the bottom tide and, especially, for the surface tide can be used in conjunction with all of the tidal constituents. The point-mass adjustment model, based on the residuals from the spherical-harmonic adjustment of satellite altimetry, was recently

modified to allow for an efficient, large-scale resolution of the geoidal detail. As an alternative to the point-mass adjustment (without tidal parameters), an approach is presented which is an adaptation of the collocation theory. GRA

N84-29498*# Old Dominion Univ., Norfolk, Va. Dept. of Physics.
PROGRAMMING FOR ENERGY MONITORING/DISPLAY SYSTEM IN MULTICOLOR LIDAR SYSTEM RESEARCH Progress Report, 15 Jun. 1980 - 14 Jun. 1981
 R. C. ALVARADO, JR. and R. J. ALLEN Mar. 1982 110 p refs
 (Contract NCC1-32)
 (NASA-CR-165875; NAS 1.26:165875; PTR-81-11) Avail: NTIS HC A06/MF A01 CSCL 09B

The Z80 microprocessor based computer program that directs and controls the operation of the six channel energy monitoring/display system that is a part of the NASA Multipurpose Airborne Differential Absorption Lidar (DIAL) system is described. The program is written in the Z80 assembly language and is located on EPROM memories. All source and assembled listings of the main program, five subroutines, and two service routines along with flow charts and memory maps are included. A combinational block diagram shows the interfacing (including port addresses) between the six power sensors, displays, front panel controls, the main general purpose minicomputer, and this dedicated microcomputer system. M.A.C.

N84-30359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT-4 SCIENCE INVESTIGATIONS SUMMARY, INCLUDING DECEMBER 1983 WORKSHOP RESULTS, VOLUME 1
 J. L. BARKER, ed. Jul. 1984 213 p refs Proc. of LANDSAT-4 Early Results Symp., held in Greenbelt, Md., 22-24 Feb. 1983 and LANDSAT Sci. Characterization Workshop, held in Greenbelt, Md., 6 Dec. 1983 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS 2 Vol.
 (E84-10166; NASA-CP-2326-VOL-1; NAS 1.55:2326-VOL-1)
 Avail: NTIS HC A10/MF A01 CSCL 08B

A general overview of the LANDSAT 4 system with emphasis on the Thematic Mapper (TM) is presented. A variety of topics on the design, calibration, capabilities, and image processing techniques of the TM sensor are discussed in detail. The comparison of TM data with other MSS data is also investigated.

N84-30361*# General Electric Co., Philadelphia, Pa.
LANDSAT-4 SYSTEM DESCRIPTION
 T. C. AEPLI /n NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 15-30 Jul. 1984 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 22B

The LANDSAT 4 system design and capabilities are examined. A detailed description of the satellite is presented as well as ground control facility responsibilities, image processing and communications, and examples of TM and MSS data. M.A.C.

N84-30362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL SCANNER (MSS) INSTRUMENT DESCRIPTION
 J. L. BARKER and G. BANKS /n its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 31-40 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 14B

The MSS sensor image processing and resolution capabilities as well as a general system description are presented in chart form. Emphasis is placed on absolute radiometric calibration, video and wedge level timing sequence, focal plane dimensions, sampling

sequence, and a description of the mirror coordinate systems. M.A.C.

N84-30363*# Santa Barbara Research Center, Goleta, Calif.
THEMATIC MAPPER (TM) INSTRUMENT DESCRIPTION
 J. ENGEL /n NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 41-61 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 14B

A detailed description of the thematic mapper (TM) instrument is presented in chart form. A comparison is made between TM and MSS capabilities. Applications for TM data are also included. M.A.C.

N84-30364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OVERVIEW OF LANDSAT-4 AND THE THEMATIC MAPPER
 J. R. IRONS /n its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 62-64 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 08B

The LANDSAT 4 satellite and its orbit, the Thematic Mapper (TM) sensor design, and the ground processing of TM data are discussed. The design of LANDSAT 4 incorporates several technological advancements which include the TM. The TM offers refinements over the familiar Multispectral Scanners (MSS's) aboard all of the LANDSAT satellites in terms of spatial, spectral, and radiometric resolutions. The TM data undergo radiometric and geometric corrections on the ground to provide investigators with pictorial and digital image data products. M.A.C.

N84-30365*# Santa Barbara Research Center, Goleta, Calif.
THEMATIC MAPPER SENSOR CHARACTERISTICS
 J. ENGEL /n NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 65-89 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 08B

The characteristics of the thematic mapper (TM) sensor onboard the LANDSAT 4 satellite are discussed. Topics include instantaneous field of view size, rise time, delay time, square wave response, bright target recovery, altitude effects, band to band registration, and scan profile linearity. M.A.C.

N84-30366*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIOMETRIC CALIBRATION AND PROCESSING PROCEDURE FOR REFLECTIVE BANDS ON LANDSAT-4 PROTOFLIGHT THEMATIC MAPPER
 J. L. BARKER, R. B. ABRAMS (Computer Sciences Corp., Silver Spring, Md.), D. L. BALL (Computer Sciences Corp., Silver Spring, Md.), and K. C. LEUNG (Computer Sciences Corp., Silver Spring, Md.) /n its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 90-91 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 08B

Descriptive and procedural background material for understanding results from radiometric calibration of the reflective bands and digital image products of the thermal mapper (TM) are discussed. The radiometric subsystems of the TM are described, with emphasis on the internal calibrator pulse shapes and timing cycle. M.A.C.

N84-30367*# General Electric Co., Philadelphia, Pa.
AN OVERVIEW OF THE THEMATIC MAPPER GEOMETRIC CORRECTION SYSTEM
 E. P. BEYER /n NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 92-100 Jul. 1984 ERTS
 Avail: NTIS HC A10/MF A01 CSCL 08B

The processing concepts which form the basis of the Thematic Mapper (TM) Geometric Correction System are examined. The principle flight and ground segment subsystems are discussed. Correction data is generated and compared to TM image data.

Geometric accuracy is defined and investigated along with a general system overview. M.A.C.

N84-30372*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPECTRAL CHARACTERIZATION OF THE LANDSAT THEMATIC MAPPER SENSORS

B. L. MARKHAM and J. L. BARKER *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 127-129 Jul. 1984 Previously announced as N84-15634 ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

Data collected on the spectral characteristics of the LANDSAT-4 and LANDSAT-4 backup thematic mapper instruments, the protoflight (TM/PF) and flight (TM/F) models, respectively, are presented and analyzed. Tests were conducted on the instruments and their components to determine compliance with two sets of spectral specifications: band-by-band spectral coverage and channel-by-channel within-band spectral matching. Spectral coverage specifications were placed on: (1) band edges - points at 50% of peak response, (2) band edge slopes - steepness of rise and fall-off of response, (3) spectral flatness - evenness of response between edges, and (4) spurious system response - ratio of out-of-band response to in-band response. Compliance with the spectral coverage specifications was determined by analysis of spectral measurements on the individual components contributing to the overall spectral response: filters, detectors, and optical surfaces. M.G.

N84-30373*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PRE-LAUNCH ABSOLUTE RADIOMETRIC CALIBRATION OF LANDSAT-4 PROTOFLIGHT THEMATIC MAPPER

J. L. BARKER, D. L. BALL (Computer Sciences Corp., Silver Spring, Md.), K. C. LEUNG (Computer Sciences Corp., Silver Spring, Md.), and J. A. WALKER (Santa Barbara Research Center, Goleta, Calif.) *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 130-139 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 14B

From both scientific and applications perspectives, the usefulness of TM digital imagery is significantly determined by its radiometric characteristics. This includes both the accuracy to which the dynamic range is known and its radiometric reproducibility or precision. Results from several pre-launch tests with a 122-cm Integrating Sphere (IS) used as part of the absolute radiometric calibration experiments for the protoflight TM sensor carried on the LANDSAT-4 satellite are summarized and analyzed. Topics covered include TM radiometric calibration and sensitivity; the TM internal calibrator; and the dynamic range after calibration.

A.R.H.

N84-30376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THERMAL BAND CHARACTERIZATION OF LANDSAT-4 THEMATIC MAPPER

J. C. LANSING (Santa Barbara Research Center, Goleta, Calif.) and J. L. BARKER *In its* LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 186-188 Jul. 1984 ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

A quick look monitor in the spacecraft control center was used to measure the TM Band 6 shutter background and the 34.7 C internal blackbody signal on over 50 dates. Comparison of relative internal gains between the four channels to prelaunch values showed changes over 9 months of up to 5%, while 512 x 512 subsections of the original 10 daytime scenes showed scene counts that ranged from 135 down to 62. A night scene of the Buffalo area was used to determine channel gain relative to the mean and to discern a systematic along scan pattern in a difference between forward and reverse scan counts of up to 0.5. A corrected digital image was produced and individual gains and offsets were calculated for the four channels. At satellite radiance was determined and noise equivalent temperature difference was calculated. The

calibration data and the Buffalo scene, with the corrections and estimates of the atmospheric transmission and radiance, were used to make a temperature estimate for an area of Lake Erie of 21 C to 27 C. Local records of the temperature showed 21 C. A.R.H.

N84-30381*# Purdue Univ., Lafayette, Ind.

LANDSAT-4 MSS AND TM SPECTRAL CLASS COMPARISON AND COHERENT NOISE ANALYSIS

P. E. ANUTA, L. BARTOLUCCI, E. DEAN, F. LOZANO, E. MALARET, C. D. MCGILLEM, J. VALDES, and C. VALENZUELA *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 1-6 Jul. 1984 refs ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

A detailed spectral analysis is conducted of thematic mapper and MSS data for an area near Des Moines, Iowa. Data are utilized from 7 blocks distributed throughout the area which included agricultural, forest, suburban, urban, and water scene types. The blocks are processed using a clustering algorithm to produce up to 18 cluster groupings for each block. Each cluster class is then identified with a ground-cover class using aerial photography and maps of the area. The clusters from each of the 7 blocks are inspected with regard to separability, mean, and variances. The separability measure used in the transformed divergence function or processor measures the statistical distance between classes based on class means and covariance matrices. The measure has a maximum value of 2,000 and the minimum of 0. Spectrally, very close classes will typically have values as low as 50 to 500.

M.A.C.

N84-30382*# European Space Agency. ESRIN, Frascati (Italy). Earthnet Programme Office.

TM FAILED DETECTORS DATA REPLACEMENT

L. FUSCO and D. TREVESE *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 7-14 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 14B

Some of the LANDSAT 4 Thematic Mapper detectors (band 2 detector 4 and band 5 detector 3) have inadequate performances. The operational system correction processing will disregard the data sensed by the failed detectors and replace them by data coming from the neighbor detectors of the same spectra band. The analysis performed by ESA Earthnet and attempts to suggest an operational failed detector replacement algorithm are described.

M.A.C.

N84-30383*# Arizona Univ., Tucson. Remote Sensing Center. **IN-FLIGHT ABSOLUTE RADIOMETRIC CALIBRATION OF THE THEMATIC MAPPER**

K. R. CASTLE, R. G. HOLM, C. J. KASTNER, J. M. PALMER, P. N. SLATER, M. DINGUIRARD (Centre d'Etudes et de Recherche de Toulouse, France), C. E. EZRA (Dept. of Agriculture, Beltsville, Md.), D. JACKSON (Dept. of Agriculture, Beltsville, Md.), and R. K. SAVAGE (Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.) *In* NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 15-19 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 14B

The Thematic Mapper (TM) multispectral scanner system was placed into Earth orbit on July 16, 1982, as part of NASA's LANDSAT 4 payload. To determine temporal changes of the absolute radiometric calibration of the entire system in flight, spectroradiometric measurements of the ground and the atmosphere are made simultaneously with TM image acquisitions over the White Sands, New Mexico area. By entering the measured values into an atmospheric radiative transfer program, the radiance levels at the entrance pupil of the TM in four of the TM spectral bands are determined. These levels are compared to the output digital counts from the detectors that sampled the radiometrically measured ground area, thus providing an absolute radiometric calibration of the entire TM system utilizing those detectors. By reference to an adjacent, larger uniform area, the calibration is extended to all 16 detectors in each of the three bands. M.A.C.

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N84-30384*# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.

LANDSAT-4 THEMATIC MAPPER CALIBRATION AND ATMOSPHERIC CORRECTION Abstract Only

W. A. HOVIS /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 20 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 14B

In order to utilize the quantitative accuracy built into the Thematic Mapper effectively, more attention must be paid to calibration before launch, changes of calibration before launch, changes of calibration with time in orbit, and atmospheric interference with the measurements, especially in the 450 to 520 nanometer band. Recent experience with the Coastal Zone Color Scanner (CZCS) program has led to procedures wherein Rayleigh correction factors can be generated utilizing simultaneous surface truth data that empirically give correct upwelled surface radiances. Instruments, such as the CZCS, have shown that calibration changes first, and to the largest degree, at the shorter wave lengths, with lesser changes as wave length increases. These techniques are utilized to calculate a Rayleigh correction factor that, together with geometric terms, will give an accurate correction for this portion of the atmospheric contribution to the signal. M.A.C.

N84-30386*# Environmental Research Inst. of Michigan, Ann Arbor.

SCAN-ANGLE AND DETECTOR EFFECTS IN THEMATIC MAPPER RADIOMETRY

M. D. METZLER and W. A. MALILA /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 23-27 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

The performance of the Thematic Mapper (TM) as manifested by the quality of its image data is examined in order to suggest possible improvements for data production and assess the effects of data quality on its utility for land resources applications. The major emphasis is on the radiometric characteristics of TM data, with some attention to spatial and spectral characteristics. M.A.C.

N84-30388*# Arizona Univ., Tucson.

MTF ANALYSIS OF LANDSAT-4 THEMATIC MAPPER Abstract Only

R. SCHOWENGERDT /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 32 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

A research program to measure the LANDSAT 4 Thematic Mapper (TM) modulation transfer function (MTF) is described. Measurement of a satellite sensor's MTF requires the use of a calibrated ground target, i.e., the spatial radiance distribution of the target must be known to a resolution at least four to five times greater than that of the system under test. A small reflective mirror or a dark light linear pattern such as line or edge, and relatively high resolution underflight imagery are used to calibrate the target. A technique that utilizes an analytical model for the scene spatial frequency power spectrum will be investigated as an alternative to calibration of the scene. The test sites and analysis techniques are also described. M.A.C.

N84-30396*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ASSESSMENT OF THEMATIC MAPPER BAND-TO-BAND REGISTRATION BY THE BLOCK CORRELATION METHOD Abstract Only

D. H. CARD, R. C. WRIGLEY, F. C. MERTZ (Technicolor Government Services, Inc., Moffett Field, Calif.), and J. R. HALL (Technicolor Government Services, Inc., Moffett Field, Calif.) /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 55-58 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 08B

The design of the Thematic Mapper (TM) multispectral radiometer makes it susceptible to band-to-band misregistration. To estimate band-to-band misregistration a block correlation method is employed. This method is chosen over other possible techniques (band differencing and flickering) because quantitative results are produced. The method correlates rectangular blocks of pixels from one band against blocks centered on identical pixels from a second band. The block pairs are shifted in pixel increments both vertically and horizontally with respect to each other and the correlation coefficient for each shift position is computed. The displacement corresponding to the maximum correlation is taken as the best estimate of registration error for each block pair. Subpixel shifts are estimated by a bi-quadratic interpolation of the correlation values surrounding the maximum correlation. To obtain statistical summaries for each band combination post processing of the block correlation results performed. The method results in estimates of registration error that are consistent with expectations. M.A.C.

N84-30399*# EROS Data Center, Sioux Falls, S. Dak.

GEODETIC ACCURACY OF LANDSAT-4 MULTISPECTRAL SCANNER AND THEMATIC MAPPER DATA Abstract Only

J. M. THORMODSGARD and D. J. DEVRIES /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 62-63 Jul. 1984 ERTS

Avail: NTIS HC A09/MF A01 CSCL 05B

The geodetic accuracy of an MSS or TM scene is assessed using a minicomputer and appropriate software, a digitizer, and an image display device. The calculated image location of a selected feature is compared with the actual image location obtained through visual inspection of the image on the display. Measurements of 15 to 20 features evenly distributed throughout the image provide an estimate of the geodetic accuracy of the scene. Tests of two system-corrected MSS scenes measured geodetic registration root-mean-square (RMS) errors of approximately 3,200 m or 57 pixels. Tests of two TM system-corrected scenes measured RMS errors of approximately 1,250 and 1,000 m, or 44 and 35 pixels, respectively. All errors were primarily translational, implying good internal scene registration of both MSS and TM data. The one MSS GCP-corrected scene which was evaluated had an RMS error of approximately 325 m or 6 pixels. A.R.H.

N84-30402*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPECTRAL CHARACTERIZATION OF THE LANDSAT-4 MSS SENSORS

B. L. MARKHAM and J. L. BARKER /in its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 73-75 Jul. 1984 Previously announced as N84-15634 ERTS

Avail: NTIS HC A09/MF A01 CSCL 14B

Relative spectral response data for the LANDSAT-4 and LANDSAT-4 backup multispectral scanner subsystems (MSS), the preflight and flight models are presented and compared to similar data for the LANDSAT 1, 2 and 3 scanners. Channel (six channels per band) outputs for soil and soybean targets were simulated and compared within each band and between scanners. The principal differences between the spectral responses of the LANDSAT-4 scanners and previous scanners are discussed. The simulated LANDSAT-4 scanner outputs were 3 to 10 percent lower

in the red band and 3 to 11 percent higher in the first near-IR band than previous scanners for the soybeans targets. The LANDSAT-4 scanners were generally more uniform from channel to channel within bands than previous scanners. In the upper-band edge of the red band of the protoflight scanner, one channel was markedly different (12 nm) from the rest. For a soybeans target, this nonuniformity resulted in a within-band difference of 6.2 percent in simulated outputs between channels. A.R.H.

N84-30403*# Environmental Research Inst. of Michigan, Ann Arbor.

INVESTIGATION OF RADIOMETRIC PROPERTIES OF LANDSAT-4 MSS

D. R. RICE and W. A. MALILA /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 76-80 Jul. 1984 refs ERTS Avail: NTIS HC A09/MF A01 CSCL 14B

Two full frames of radiometrically corrected (Type A) LANDSAT-4 MSS data were analyzed digitally and visually for evidence of residual calibration differences between detectors, quantization effects, and other sensor-related artifacts. Both standard statistical and Fourier analysis techniques were employed. Opportunities for coincident coverage by LANDSAT 3 and 4 were identified in the contiguous 48 states. Paired acquisitions for two scenes were obtained and analyzed to establish relationships between signal values from common areas imaged by the MSS systems. Another pair with coverage by LANDSAT 2 and 4 was obtained and analyzed. Detector-to-detector differences, coherent noise, line length variation, and LANDSAT 4 to LANDSAT 3 calibration are discussed. A.R.H.

N84-30404*# Canada Centre for Remote Sensing, Ottawa (Ontario).

RADIOMETRIC CALIBRATION AND GEOCODED PRECISION PROCESSING OF LANDSAT-4 MULTISPECTRAL SCANNER PRODUCTS BY THE CANADA CENTRE FOR REMOTE SENSING Abstract Only

J. MURPHY, D. BENNETT, and F. E. GUERTIN /in NASA. Goddard Space Flight Center LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 2 p 81 Jul. 1984 ERTS Avail: NTIS HC A09/MF A01 CSCL 05B

Inherent in the method used by CCRS for the radiometric calibration of LANDSAT-4 MSS data is the possibility for the user to convert the corrected digital values to the absolute scene radiance of the target under observation. The generation of the constants needed for this final conversion requires both the pre-launch and post-launch radiometric calibration constants as supplied by NASA. Results of some preliminary comparative studies of the radiometric properties of the LANDSAT-4 MSS versus earlier satellites in the LANDSAT series are presented as well as early observations on the stability of the calibration data, within one scene, within one orbit, and over a period of several months. Residual striping in the corrected products is estimated. The method used to perform precision processing of the LANDSAT MSS data for generating geocoded or map compatible LANDSAT MSS products in the Universal Transverse Mercator projection is also reviewed. LANDSAT-4 MSS precision processed products are evaluated for geodetic accuracy, and are compared to similar products from the previous LANDSAT satellites to assess the orbit independent registration accuracy. A.R.H.

N84-30514# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.

A DESCRIPTION OF THE MIZEX 1984 REMOTE SENSING ACTIVITIES

May 1984 40 p
(Contract N00014-82-C-0663)
(AD-A142296; AD-E750179; ERIM-163500-4-T) Avail: NTIS HC A03/MF A01 CSCL 17I

The remote sensing program for MIZEX 84 will involve the coordinated efforts of both ice and ocean scientists using microwave, infrared, and visual remote sensors to investigate MIZ phenomena. Operating from surface, helicopter, ship, aircraft, and

satellite platforms, these sensors should provide information on all scales of MIZ processes. This experiment plan sets forth the scientific and operational objectives of these remote sensing efforts and summarizes the individual measurement plans.

Author (GRA)

N84-31515# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

PHASE MODULATOR IN 41.650 MHZ [MODULADOR DE FASE EM 401,650 MHZ]

P. ADABO and J. A. RODRIGUES Jul. 1984 15 p refs In PORTUGUESE; ENGLISH summary Presented at the 36th Reuniao Anual da Soc. de Brasileira para o Progr. da Cienc. - SBPC, Sao Paulo, 4-11 Jul. 1984
(INPE-3177-PRE/544) Avail: NTIS HC A02/MF A01

The design of a phase modulator in 401.650 MHz, which was developed as an alternative for the transmitter modulator of a meteorological and hydrological data collection system by satellite is presented. This system collects and transmits environmental data to a reception center by data collection platforms, through a satellite. The modulated carrier has an angle deviation of ± 60 deg or -60 deg, corresponding to the digital data levels. The modulator consists basically of a phase locked loop (PLL) with a voltage controlled oscillator (VCO) in 401.650 MHz. The VCO frequency is divided by 64 and phase locked to a high stability reference. The modulation is made at 401.650 MHz with the modulation signal introduced after the phase comparator. E.A.K.

N84-31731*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIOMETRIC CALIBRATION AND PROCESSING PROCEDURE FOR REFLECTIVE BANDS ON LANDSAT-4 PROTOFLIGHT THEMATIC MAPPER

J. L. BARKER, R. B. ABRAMS, D. L. BALL, and K. C. LEUNG 1984 40 p refs Prepared in cooperation with Computer Sciences Corp., Silver Spring, Md. ERTS
(E84-10056; NASA-TM-85597; NAS 1.15:85597) Avail: NTIS HC A03/MF A01 CSCL 08B

The radiometric subsystem of NASA's LANDSAT-4 Thematic Mapper (TM) sensor is described. Special emphasis is placed on the internal calibrator (IC) pulse shapes and timing cycle. The procedures for the absolute radiometric calibration of the TM channels with a 122-centimeter integrating sphere and the transfer of radiometric calibration from the channels to the IC are reviewed. The use of the IC to calibrate TM data in the ground processing system consists of pulse integration, pulse averaging, IC state identification, linear regression analysis, and histogram equalization. An overview of the SCROUNGE-era (before August 1983) method is presented. Procedural differences between SCROUNGE and the TIPS-era (after July 1983) and the implications of these differences are discussed. Author

N84-31732*# City Coll. of the City Univ. of New York. Inst. of Marine and Atmospheric Sciences.

SYNOPTIC SCALE WIND FIELD PROPERTIES FROM THE SEASAT SASS

W. J. PIERSON, JR., W. B. SYLVESTER, and R. E. SALFI Washington NASA Jul. 1984 212 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAGW-266)

(E84-10169; NASA-CR-3810; NAS 1.26:3810) Avail: NTIS HC A10/MF A01 CSCL 04B

Dealiased SEASAT SEASAT A Scatterometer System SASS vector winds obtained during the Gulf Of Alaska SEASAT Experiment GOASEX program are processed to obtain superobservations centered on a one degree by one degree grid. The grid. The results provide values for the combined effects of mesoscale variability and communication noise on the individual SASS winds. These superobservations winds are then processed further to obtain estimates of synoptic scale vector winds stress fields, the horizontal divergence of the wind, the curl of the wind stress and the vertical velocity at 200 m above the sea surface,

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each with appropriate standard deviations of the estimates for each grid point value. They also explain the concentration of water vapor, liquid water and precipitation found by means of the SMMR Scanning Multichannel Microwave Radiometer at fronts and occlusions in terms of strong warm, moist air advection in the warm air sector accompanied by convergence in the friction layer. Their quality is far superior to that of analyses based on conventional data, which are shown to yield many inconsistencies. M.A.C.

N84-31734*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHARACTERIZATION OF THE LANDSAT SENSORS' SPATIAL RESPONSES

B. L. MARKHAM Jul. 1984 78 p refs ERTS
(E84-10171; NASA-TM-86130; NAS 1.15:86130) Avail: NTIS
HC A05/MF A01 CSCL 14B

The characteristics of the thematic mapper (TM) and multispectral scanner (MSS) sensors on LANDSATs 4 and 5 affecting their spatial responses are described, and functions defining the response of the system to an arbitrary input spatial pattern are derived, i.e., transfer functions (TF) and line spread functions (LSF). These design LSF's and TF's were modified based on prelaunch component and system measurements to provide improved estimates. Prelaunch estimates of LSF/TF's are compared to in-orbit estimates. For the MSS instruments, only limited prelaunch scan direction square-wave response (SWR) data were available. Design estimates were modified by convolving in Gaussian blur till the derived LSF/TF's produced SWR's comparable to the measurements. The two MSS instruments were comparable at their temperatures of best focus; separate calculations were performed for bands 1 and 3, band 2 and band 4. The pre-sample nadir effective instantaneous field's of view (EIFOV's) based on the .5 modulation transfer function (MTF) criteria vary from 70 to 75 meters in the track direction and 79 to 82 meters in the scan direction. For the TM instruments more extensive prelaunch measurements were available. Bands 1 to 4, 5 and 7, and 6 were handled separately as were the two instruments. Derived MTF's indicate nadir pre-sample EIFOV's of 32 to 33 meter track (bands 1 to 5, 7) and 36 meter scan (bands 1 to 5, 7) and 1245 meter track (band 6) and 141 meter scan (band 6) for both TM's. Author

N84-31750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RELATIVE RADIOMETRIC CALIBRATION OF LANDSAT TM REFLECTIVE BANDS

J. L. BARKER 1984 39 p ERTS
(E84-10179; NASA-TM-85599; NAS 1.15:85599) Avail: NTIS
HC A03/MF A01 CSCL 05B

Raw thematic mapper (TM) calibration data from pre-launch tests and in-orbit acquisitions from LANDSAT 4 and 5 satellites are analyzed to assess the radiometric characteristics of the TM sensor. A software program called TM radiometric and algorithmic performance program (TRAPP) was used for the majority of analyses. Radiometric uncertainty in the final TM image originates from: (1) scene variability (solar irradiance and atmospheric scattering); (2) optical and electrical variability of the sensor; and (3) variability introduced during image processing. R.S.F.

N84-31751*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PRELAUNCH ABSOLUTE RADIOMETRIC CALIBRATION OF THE REFLECTIVE BANDS ON THE LANDSAT-4 PROTOFLIGHT THEMATIC MAPPER

J. L. BARKER, D. L. BALL (Computer Sciences Corp., Silver Spring, Md.), K. C. LEUNG (Computer Sciences Corp., Silver Spring, Md.), and J. A. WALKER (Santa Barbara Research Center, Goleta, Calif.) 1984 96 p refs ERTS
(E84-10180; NASA-TM-85600; NAS 1.15:85600) Avail: NTIS
HC A05/MF A01 CSCL 08B

The results of the absolute radiometric calibration of the LANDSAT 4 thematic mapper, as determined during pre-launch

tests with a 122 cm integrating sphere, are presented. Detailed results for the best calibration of the protoflight TM are given, as well as summaries of other tests performed on the sensor. The dynamic range of the TM is within a few per cent of that required in all bands, except bands 1 and 3. Three detectors failed to pass the minimum SNR specified for their respective bands: band 5, channel 3 (dead), band 2, and channels 2 and 4 (noisy or slow response). Estimates of the absolute calibration accuracy for the TM show that the detectors are typically calibrated to 5% absolute error for the reflective bands; 10% full-scale accuracy was specified. Ten tests performed to transfer the detector absolute calibration to the internal calibrator show a 5% range at full scale in the transfer calibration; however, in two cases band 5 showed a 10% and a 7% difference. Author

N84-31752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PRELAUNCH ABSOLUTE RADIOMETRIC CALIBRATION OF LANDSAT-4 PROTOFLIGHT THEMATIC MAPPER

J. L. BARKER, D. L. BALL (Computer Sciences Corp., Silver Spring, Md.), K. C. LEUNG (Computer Sciences Corp., Silver Spring, Md.), and J. A. WALKER (Santa Barbara Research Center, Goleta, Calif.) 1984 10 p ERTS
(E84-10181; NASA-TM-85601; NAS 1.15:85601) Avail: NTIS
HC A02/MF A01 CSCL 08B

Results are summarized and analyzed from several prelaunch tests with a 122 cm integrating sphere used as part of the absolute radiometric calibration experiments for the protoflight TM sensor carried on the LANDSAT-4 satellite. The calibration procedure is presented and the radiometric sensitivity of the TM is assessed. The internal calibrator and dynamic range after calibration are considered. Tables show dynamic range after ground processing, spectral radiance to digital number and digital number to spectral radiance values for TM bands 1, 2, 3, 4, 5, 7 and for channel 4 of band 6. A.R.H.

N84-31755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPECTRAL CHARACTERIZATION OF THE LANDSAT THEMATIC MAPPER SENSORS

B. L. MARKHAM and J. L. BARKER 1984 44 p refs ERTS
(E84-10184; NASA-TM-85621; NAS 1.15:85621) Avail: NTIS
HC A03/MF A01 CSCL 08B

The spectral coverage characteristics of the two thematic mapper instruments were determined by analyses of spectral measurements of the optics, filters, and detectors. The following results are presented: (1) band 2 and 3 flatness was slightly below specification, and band 7 flatness was below specification; (2) band 5 upper-band edge was higher than specifications; (3) band 2 band edges were shifted upward about 9 nm relative to nominal; and (4) band 4, 5, and 7 lower band edges were 16 to 18 nm higher than nominal. R.S.F.

N84-31756*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

INTRODUCTION TO THEMATIC MAPPER INVESTIGATIONS. SECTION 1: RADIOMETRY. SECTION 2: GEOMETRY

J. L. BARKER and B. L. MARKHAM 1984 15 p refs ERTS
(E84-10185; NASA-TM-85622; NAS 1.15:85622) Avail: NTIS
HC A02/MF A01 CSCL 08B

An overview of papers which deal with radiometric characterization of the TM sensor is presented. Spectral characteristics are summarized. The geometric accuracy of TM are also examined. Aspects of prelaunch and post launch sensor performance, ground processing techniques, and error correction are also investigated. M.A.C.

N84-33857# European Space Agency, Paris (France).
INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS) 84. REMOTE SENSING: FROM RESEARCH TOWARDS OPERATIONAL USE, VOLUME 1

T. D. GUYENNE, ed. and J. J. HUNT, ed. Aug. 1984 574 p refs Partly in ENGLISH and FRENCH Proc. held at Strasbourg, 27-30 Aug. 1984; sponsored by IEEE Geoscience and Remote Sensing Society, Council of Europe, CNES, DFVLR, EARSeL, ESA and NASA Original contains color illustrations 2 Vol. (ESA-SP-215-VOL-1; ISSN-0379-6566) Avail: NTIS HC A24/MF A01; ESA, Paris \$44

Spacelab Metric Camera experiments; the Modular Optoelectronic Multispectral Scanner; LANDSAT Thematic Mapper; vegetation monitoring; microwave monitoring in geology, pedology and hydrology; multitemporal monitoring; remote sensing of land use; multisensor monitoring; sea surface, waves and winds remote sensing; ice mapping; atmospheric sounding; optical, infrared and radar sensors; electromagnetic probing; and air and water pollution monitoring were discussed.

N84-33858# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany). Inst. fuer Optoelektronik.

FLIGHT PERFORMANCE OF THE SPACELAB METRIC CAMERA EXPERIMENT

M. SCHROEDER /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 3-14 Aug. 1984 refs Original contains color illustrations
 Avail: NTIS HC A24/MF A01

The Spacelab metric camera experiment acquired stereoscopic high resolution black and white and color infrared photographs of various regions of the world to test the mapping capability of high resolution space photography for compiling topographic and thematic maps especially in unpopulated or less developed regions of the world, and updating and revising topographic and thematic maps in populated and developed areas of the world. An area of 11 million sq km was covered. Due to the delayed November 28 launch date, illumination conditions were frequently poor over many candidate targets. However, high quality images with a ground resolution of 20 m were obtained by increasing camera exposure time.
 Author (ESA)

N84-33859# Politecnico di Milano (Italy). Ist. di Topografia, Fotogrammetria e Geofisica.

ANALYSIS OF THE METRIC CAMERA BLACK AND WHITE IMAGES OVER ITALY

G. TOGLIATTI and A. MORIONDO /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 15-18 Aug. 1984
 Avail: NTIS HC A24/MF A01

Spacelab metric camera based altimetric and planimetric measurements are discussed. Photographic quality is poorer than expected due to a spool accident, lighting conditions and to the absence of an image motion compensator. The latter is essential for all future missions, to make the use of slower films possible. Given the very good metric performances of the satellite images, the adoption of color film is suggested, since the small loss of accuracy could be afforded in order to enhance color contrast between different objects.
 Author (ESA)

N84-33860# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

SOME CONSIDERATIONS OF THE OPERATIONS OF OPTICAL IMAGING SPACE SENSORS DERIVED FROM THE EXPERIENCE OF THE METRIC CAMERA PROJECT

M. L. REYNOLDS and D. SOEDERMAN (European Centre for Medium-Range Weather Forecasts) /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 19-22 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

Communication problems caused by operating the Spacelab metric camera by a technical team attempting to provide an image

data product to a large number of data users, and managing resources so as to optimize the return of usable data are discussed. As the number of experimenters participating in the exploitation of Earth Observation facilities increases, the difficulty of communications becomes more apparent. The electronic mail box is a viable alternative to conventional systems. Spacelab proves the possibility to plan resource utilization on the basis of cloud cover production. It should thus be possible to appreciably reduce the quantity of useless image data being collected, recorded, transmitted and processed.
 Author (ESA)

N84-33861# Technische Univ., Munich (West Germany).
MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS) PROGRAM OUTLINE AND FUTURE ASPECTS

J. BODECHTEL /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 25-27 Aug. 1984
 Avail: NTIS HC A24/MF A01

The Modular Optoelectronic Multispectral Scanner (MOMS) was designed for regional and global optical remote sensing applications. It was mounted on the Shuttle Pallet Satellite aboard STS-7 and STS-11. The missions served the technological space verification of the sensor and the demonstration of geoscientific and application-oriented experiments in worldwide distributed areas. Development aims include the realization of a complex remote sensing device.
 Author (ESA)

N84-33862# Technische Univ., Munich (West Germany).
MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS)-01 ON STS-7 AND STS-11: MISSIONS AND RESULTS

J. BODECHTEL, D. MEISSNER (MBB GmbH, Ottobrunn, West Germany), P. SEIGE (DFVLR), R. HAYDN (DFVLR), and H. WINKENBACH /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 29-32 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

The Modular Optoelectronic Multispectral Scanner (MOMS) missions on STS-7 and 11 are summarized. The MOMS scientific and technical objectives included mapping of different ground targets with low to high contrast and albedo in visible and near infrared part of the spectrum over arid areas, areas with dense and sparse natural vegetation, coastal zones, mountainous regions and open ocean; and system verification under space conditions for the two channel version to demonstrate the capability for scan line extension and the ability to combine pixel-coincident modules. Results indicate that radiometric and geometric properties of MOMS data are satisfactory.
 Author (ESA)

N84-33863# Technische Univ., Munich (West Germany).
THE INFORMATION NETWORK FOR A REAL-TIME CONTROLLED DATA ACQUISITION OF THE MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS)

J. BODECHTEL, K. HILLER (DFVLR, Oberpfaffenhofen, West Germany), G. LANDAUER (DFVLR, Oberpfaffenhofen, West Germany), P. SEIGE (DFVLR, Oberpfaffenhofen, West Germany), A. YAMANI, and J. ZILGER /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 33-36 Aug. 1984 refs
 Avail: NTIS HC A24/MF A01

To maximize the scientific profit of the Modular Optoelectronic Multispectral Scanner missions during STS-7 and STS-11 flights, an information network for real-time controlled data acquisition was set up. Geoscientific preinformation and weather data of geostationary weather satellites were used to define the areas for imaging sequences. For Earth oriented dedicated missions, the model optimizes data acquisition by avoiding imaging over cloud-covered or geoscientifically irrelevant areas.
 Author (ESA)

08 INSTRUMENTATION AND SENSORS

N84-33864# Technische Univ., Munich (West Germany). Inst. fuer Allgemeine und Angewandte Geologie.

SPECTRAL SIGNIFICANCE OF MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS) VERSUS LANDSAT DATA AND FUTURE ASPECTS: PRELIMINARY RESULTS

H. KAUFMANN, J. BODECHTEL, and R. HAYDN /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 39-44 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

During the Modular Optoelectronic Multispectral Scanner (MOMS) missions on STS-7 and 11, data of different climate zones were acquired over worldwide distributed target areas. Geometric and radiometric properties and the significance of spectral bands are discussed. The extension of MOMS by a SWIR-band to a three channel system, and stereoscopic data acquisition are considered. The MOMS system prove to be a highly resolving instrument with exact geometric image accuracy. Apart from focusing problems of the infrared channel and striping effects caused by calibration differences the recorded data allow interpreters to produce maps to scales of 1:50,000. The two spectral bands of MOMS are well defined in the visible and near infrared and in relation to the detected surfaces are correlated. Compared to corresponding LANDSAT data they are especially sensitive to vegetated areas and are useful to identify and map limonitic and alteration zones. Author (ESA)

N84-33866# Technische Univ., Munich (West Germany). Inst. fuer Geographie.

MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS), INTERPRETATION AND EVALUATION OF THE MOMS-IMAGE ARICA, WEST COAST OF SOUTH AMERICA

H. G. GIERLOFF-EMDEN /in ESA IGARSS 84. Remote Sensing: From Res. Towards Operational Use, Vol. 1 p 49-57 Aug. 1984 refs

(Contract BMFT-FKZ-01-QS-103/3)

Avail: NTIS HC A24/MF A01

Modular Optoelectronic Multispectral Scanner (MOMS) images from northern Chile obtained during STS-7 are discussed. Thematic mapping, photogeology, and oceanographic uses are considered. Analysis shows that the MOMS-imaging experiment from orbit is successful. The MOMS System can deliver images with additional information for thematic maps (from 300 km orbit height) up to map scales 1:100,000, if the data are processed with different advanced correctional-algorithms. An evaluation for topographic maps under these conditions is possible for map scales up to 1:200 000. The geometric conditions are very good. An additional spectral band is advocated. Author (ESA)

N84-33923*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

PASSIVE MICROWAVE REMOTE SENSING OF THE ATMOSPHERE FROM SATELLITES

D. H. STAELIN /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 413-415 Aug. 1984 refs

(Contract NAG5-10)

Avail: NTIS HC A24/MF A01 CSCL 05B

Present and future satellite atmospheric sounding is discussed. Although present systems sound principally the temperature profile and the water vapor and precipitation abundances over ocean, future systems will measure other constituents such as O₃, H₂O₂, and ClO, and will provide improved spatial resolution, retrieval accuracy, and altitude coverage for temperature and humidity. Present systems with only a few channels will be replaced by systems with 20 or more, and larger antennas with more sensitive radiometers will permit horizontal resolutions of 15 to 50 km or less, even from geosynchronous orbit. The success of imaging microwave spectrometers in penetrating clouds and in yielding uniquely accurate measurements ensure a growing role in operational and research systems for these remote sensing techniques. Author (ESA)

N84-33924# National Environmental Satellite Center, Washington, D. C.

PRECIPITATION MONITORING OVER LAND FROM SATELLITES BY MICROWAVE RADIOMETRY

N. C. GRODY /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 417-422 Aug. 1984 refs Original contains color illustrations

Avail: NTIS HC A24/MF A01

Accomplishments and future opportunities of passive microwaves in deriving precipitation over land are summarized. Techniques which enhance the precipitation signature by minimizing the effect of surface emissivity on the microwave measurements are presented. Data from the Nimbus-7 scanning multichannel microwave radiometer are shown. Dual polarization or dual frequency measurements enhance the precipitation signature by reducing the effect of surface emissivity on the brightness temperature observations. Surface features such as snow, ice and wet land can be identified. Author (ESA)

N84-33925# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Electron Physics.

GROUND-BASED REMOTE SENSING OF TEMPERATURE AND WATER VAPOR BY PASSIVE MICROWAVE RADIOMETERS

J. ASKNE /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 423-429 Aug. 1984 refs Sponsored by Swedish Board for Space Activities and Swedish Space Co.

Avail: NTIS HC A24/MF A01

Ground-based microwave radiometry is discussed, and results of a temperature-profiling radiometer tested in the ONSAM-experiment are described. The results of the ONSAM-period indicate that observations at 11 frequencies yield a better result than observations at only 4. It is not meaningful to try to achieve much better absolute accuracy than the present system, i.e., 0.5 K. It is very important to observe the same air mass with the water vapor and temperature profiling radiometers. Good a priori data can be crucial in obtaining accuracy for meteorological applications. Author (ESA)

N84-33926# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

COMBINED GROUND-BASED AND SATELLITE REMOTE SENSING OF TEMPERATURE

E. R. WESTWATER and W. ZHENHUI (Nanjing Inst. of Meteorology) /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 431-436 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Results of deriving temperature and moisture from combinations of ground-based microwave and orbiting satellite (NOAA 6/7) radiometric data are presented. The accuracies of pressure heights derived from the combined data are comparable with the accuracy of pressure heights obtained from radiosondes. Some VHF radar (wavelength = 6 m) measurements of tropopause height are also used to improve temperature retrieval accuracy. Author (ESA)

N84-33929*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Earth and Space Sciences Div.

RETRIEVAL OF VERTICAL MOISTURE PROFILES WITH MICROWAVE RADIOMETRY

R. K. KAKAR and B. H. LAMBRIGHTSEN (Institute for Atmospheric Optics and Remote Sensing) /in ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 449-451 Aug. 1984 refs Sponsored by NASA

Avail: NTIS HC A24/MF A01 CSCL 05B

A statistical correlation technique is applied to the retrieval of vertical moisture profiles from downlooking radiometric measurements of atmospheric radiation at microwave wavelengths. Only an optimum subset of available radiometer channels is selected for estimating water vapor at specific pressure levels. To test its validity the algorithm was applied, in a numerical experiment, to 50 independent tropical radiosondes over a sea surface. It was also used to retrieve continuous sequences of atmospheric

moisture profiles from a set of data obtained with a 4-channel microwave radiometer carried aboard an aircraft over a land surface.
Author (ESA)

N84-33935*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Earth and Space Science Div.
EXPERIMENTAL VALIDATION OF A MILLIMETER WAVE RADAR TECHNIQUE TO REMOTELY SENSE ATMOSPHERIC PRESSURE AT THE EARTH'S SURFACE

D. A. FLOWER, G. E. PECKHAM (Heriot-Watt University), and W. J. BRADFORD (Science and Engineering Research Council, Chilton, England) *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 485-489 Aug. 1984 refs

(Contract NAS7-100)

Avail: NTIS HC A24/MF A01 CSCL 05B

Experiments with a millimeter wave radar operating on the NASA CV-990 aircraft which validate the technique for remotely sensing atmospheric pressure at the Earth's surface are described. Measurements show that the precise millimeter wave observations needed to deduce pressure from space with an accuracy of 1 mb are possible, that sea surface reflection properties agree with theory and that the measured variation of differential absorption with altitude corresponds to that expected from spectroscopic models.

Author (ESA)

N84-33936# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
STEREO METHODS IN SATELLITE METEOROLOGY

D. LORENZ *In* ESA IGARSS 84. Remote Sensing: From Res. towards Operational Use, Vol. 1 p 491-495 Aug. 1984 refs

Avail: NTIS HC A24/MF A01

Techniques for stereoscopic imaging and stereophotogrammetric measurements of clouds from space are discussed. For Europe the DFVLR concept of a Stereo Line Scanner in a polar orbit seems to be the favorable solution. It would not only improve the cloud height measurements but also provide wind determination from a polar orbit, and improve sea surface temperature measurements. The proposed Along Track Scanning Radiometer on ERS-1 is shown to be useful for a pilot experiment without specific hardware development.

Author (ESA)

N84-33946*# European Space Agency, Paris (France).
THE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS) 84. REMOTE SENSING: FROM RESEARCH TOWARDS OPERATIONAL USE, VOLUME 2

T. D. GUYENNE, ed. and J. J. HUNT, ed. Aug. 1984 328 p refs Partly in ENGLISH and FRENCH Symp. held at Strasbourg, 27-30 Aug. 1984; sponsored by NASA, IEEE Geoscience and Remote Sensing Society, Council of Europe, CNES, DFVLR, EARSel and ESA Original contains color illustrations 2 Vol.

(NASA-CR-173978; NAS 1.26:173978; ESA-SP-215-VOL-2; ISSN-0379-6566) Avail: NTIS HC A15/MF A01; ESA, Paris \$34 CSCL 08B

Synthetic aperture radar; systems components; data collection; data evaluation; optical sensor data; air pollution; water pollution; land and sea observation; active sensors (ir and w); and ers-1 are discussed.

N84-33955*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Tracking Systems and Applications Section.

CALIBRATION OF PRECISE SATELLITE ALTIMETRY FOR THE IONOSPHERE AND WET TROPOSPHERE

J. R. BENADA and P. S. CALLAHAN *In* ESA IGARSS 84: Remote Sensing: From Res. towards Operational Use, Vol. 2 p 615-618 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 14B

Ionospheric variability; dual frequency altimeter measurement of ionospheric error; and determination of wet tropospheric error from a three frequency microwave radiometer are discussed. Temporal and/or spatial extrapolations of the ionosphere are likely to result in errors of 20% to 30% of the total ionospheric effect

which is 2 to 20 cm at 13.7 GHz. The TOPEX dual frequency system can measure the effect to 1.3 cm. The TOPEX 3 frequency microwave radiometer can meet the TOPEX requirement of a 1.2 cm wet troposphere calibration, if the correction algorithm is calibrated with data from a variety of humid conditions.

Author (ESA)

N84-33976*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS): AN ADVANCED TOOL FOR EARTH REMOTE SENSING

G. VANE, M. CHRISP, H. ENMARK, and S. MACENKA, J. *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 751-757 Aug. 1984 refs Sponsored by NASA

Avail: NTIS HC A15/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) second-generation remote sensing instrument is described. The AVIRIS is an opto-mechanical scanner that uses line arrays of detectors to image a 550-pixel swath in 224 contiguous spectral bands from 0.4 to 2.4 microns. The instrument will be flown aboard a U-2 aircraft. The data processing system, based on a VAX 11-780 minicomputer, provides rapid access to flight data, and analysis software is under development.

Author (ESA)

N84-33978*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

PRELIMINARY INVESTIGATIONS CONCERNING A 90 GHZ RADIOMETER SATELLITE EXPERIMENT

F. HEEL and H. KIETZMANN *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 765-769 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 14B

Satellite radiometer studies of the Earth's surface, clouds and fog are discussed. Using a computer model, the radiation temperatures of sand, vegetation, concrete and water are determined for different atmospheric conditions. Measurements with an uncooled airborne 90 GHz radiometer test model results. To accomplish the planned experiments a special null balancing radiometer is proposed. In the case of null balancing failure this system also can be operated as total power radiometer.

Author (ESA)

N84-33980*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NASA SCATTEROMETER ON NROSS: A SYSTEM FOR GLOBAL OBSERVATIONS OF OCEANIC WINDS

F. LI, P. S. CALLAHAN, M. FREILICH, D. LAME, and C. WINN *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 777-780 Aug. 1984 refs Sponsored by NASA

Avail: NTIS HC A15/MF A01 CSCL 14B

A scatterometer to be flown on the Navy Remote Ocean Sensing System, to provide wind data, and an associated research mode data processing system are described. The scatterometer is heavily based on the Seasat scatterometer.

Author (ESA)

N84-33987*# Nippon Electric Co. Ltd., Tokyo (Japan).

A CASE STUDY OF SPACEBORNE SYNTHETIC APERTURE RADAR SYSTEM DESIGN FOR THE EARTH RESOURCES SATELLITE

H. KASHIHARA, K. TANAKA, M. FUKAI, J. KOMAI (Earth Resources Satellite Data Analysis Center, Tokyo), and M. SANO (Earth Resources Satellite Data Analysis Center, Tokyo) *In* ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 815-820 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 17I

A case study of a spaceborne SAR design, including performance parameters tradeoff between mission requirements and limitations/constraints of hardware/satellite capabilities/SAR system is described. Principal mission requirements are observation of geological features of land with the finest resolution, the highest

contrast and the largest incident angle. Radar frequency, spatial resolution, swath width and incident angle vs. output power, power consumption, antenna size, weight, data rate are discussed. Feasible SAR design menus for an Earth Resources Satellite are presented. Author (ESA)

N84-33991*# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

ERS-1 SYSTEM SIMULATION AND CALIBRATION

P. HANS, H. M. BRAUN, and H. GROEBKE /in ESA IGARSS 84 Remote Sensing: From Res. Towards Operational Use, Vol. 2 p 841-846 Aug. 1984 refs

Avail: NTIS HC A15/MF A01 CSCL 14B

The ERS-1 Radar systems cannot totally be tested on ground, so comprehensive system simulators, able to take test results of system elements and simulate the entire system chains to derive the end-to-end measurement performances are proposed. After launch and stabilization of the spacecraft and the orbit, the inflight calibration is performed by comparison of the ERS-1 measurements with ground truth information and tuning of the target models, supported by simulations to identify whether an error is caused by the system or a model uncertainty. Author (ESA)

N84-34721# Centre National d'Etudes Spatiales, Paris (France). **SPACEBORNE LASERS IN ATMOSPHERIC RESEARCH**

J. E. BLAMONT /in ESA Space Laser Appl. and Technol. (SPLAT) 4 p May 1984 refs

Avail: NTIS HC A14/MF A01

Principles of lidar technique; lidar results in atmospheric physics and chemistry; and laser utilization in space are discussed. In atmospheric science, lidar can provide tropospheric data for global prediction models. It can track stratospheric debris for monitoring pollution transport. It can provide input data for models of radiative energy exchanges, and the effect on these exchanges of atmospheric composition. Lidar could study vertical structure of abundances in the stratosphere. It could study planetary waves and stratospheric winds. Author (ESA)

N84-34725# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.

SPACEBORNE LIDAR APPLICATIONS TO METEOROLOGY AND ENVIRONMENTAL STUDIES

G. MEGIE, J. PELON, and P. FLAMANT /in ESA Space Laser Appl. and Technol. (SPLAT) 7 p May 1984 refs

Avail: NTIS HC A14/MF A01

The use of a spaceborne platform system to probe the atmosphere with high spatial resolution, applying lidar for meteorology, and environmental studies is reviewed. Cloud top height, tropospheric clouds and aerosols, cirrus clouds ice/water discrimination, stratospheric and tropospheric ozone monitoring, pressure and temperature measurements in the troposphere, and winds determination are discussed. Advantages of active laser sounding with respect to observational requirements and passive systems are emphasized. Author (ESA)

GENERAL

Includes economic analysis.

A84-41176

COLLOQUIUM ON THE SPOT EARTH OBSERVATION SYSTEM, MONTREAL, CANADA, MAY 12-14, 1982, PROCEEDINGS [COLLOQUE SUR LE SYSTEME SPOT D'OBSERVATION DE LA TERRE, MONTREAL, CANADA, MAY 12-14, 1982, COMPTES RENDUS]

G. ROCHON, ED. (Universite Laval, Sainte-Foy, Quebec, Canada) and A. CHABREUIL, ED. Colloquium sponsored by the Association Quebecoise de Teledetection and Societe Francaise de Photogrammetrie et de Teledetection. Sainte-Foy, Quebec, Canada/Saint-Mande, Val-de-Marne, France, L'Association Quebecoise de Teledetection/La Societe Francaise de Photogrammetrie et de Teledetection, 1982. 320 p. In French. For individual items see A84-41177 to A84-41196.

The capabilities and applications of the French SPOT terrestrial-remote-sensing satellite scheduled for launch in 1984 are explored in reviews and reports. The state of the art in remote sensing technology is surveyed, the progress of the individual SPOT programs is reported, and SPOT simulation studies are examined in detail. Topics discussed include radiometric simulation techniques and their representativeness, comparative simulations of SPOT and Landsat-D, ecological cartography using simulated SPOT data, digital image-processing methods, and simulated stereoscopic SPOT images of forest areas. Black-and-white and color images, diagrams, maps, and graphs are provided. T.K.

A84-41951

ENVIRONMENTAL ASSESSMENT AND RESOURCE MANAGEMENT; INTERNATIONAL SYMPOSIUM ON COMPUTER-ASSISTED CARTOGRAPHY, 5TH, AND INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING COMMISSION IV: CARTOGRAPHIC AND DATA BANK APPLICATION OF PHOTOGRAMMETRY AND REMOTE SENSING, CRYSTAL CITY, VA, AUGUST 22-28, 1982, PROCEEDINGS

J. FOREMAN, ED. Symposium sponsored by the International Society for Photogrammetry and Remote Sensing, American Society of Photogrammetry, and American Congress on Surveying and Mapping. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping (ISPRS. Volume 24-IV), 1983, 578 p. For individual items see A84-41952 to A84-41999.

Various papers on environmental assessment and resource management are presented. The subjects addressed include: automated mapping from linear array sensor data, an automated photogrammetric mapping system, comparison of Landsat-4 with earlier Landsats, data base updating by digital monopleting, digital mapping approach to U.S. public land survey data, and the EPA's environmental image analysis system. Also discussed are: flood stress mapped NOAA-7 data, integrated resources inventory using Landsat data, Landsat-3 RBV imagery for topographic mapping, observations and trends in digital cartography, preparation of simulated color orthophotoquads, registration accuracy and attitude accuracy, satellite systems for cartography, shapes classification on digital images, and problems associated with large area mapping from Landsat. C.D.

A84-41966

THE ECONOMIC FEASIBILITY OF OPERATIONAL EARTH SENSING FROM SPACE

A. P. COLVOCORESSES (U.S. Geological Survey, Reston, VA) IN: Environmental assessment and resource management; International Symposium on Computer-Assisted Cartography, 5th, and International Society for Photogrammetry and Remote Sensing Commission IV: Cartographic and Data Bank Application of Photogrammetry and Remote Sensing, Crystal City, VA, August 22-28, 1982, Proceedings. Falls Church, VA, American Society of Photogrammetry and American Congress on Surveying and Mapping, 1983, p. 149-154.

Earth-sensing satellites designed to follow Landsat involve spatial resolution in the order of 10 to 30 m as compared to the 80 m of the Landsat Multispectral Scanner (MSS). At these higher resolutions such satellites will perform inspection functions of high importance to government agencies and which are beyond the capabilities of the Landsat MSS. There is considerable evidence that nations that cannot afford their own earth-sensing satellites are willing to pay a suitable price for the capability of inspecting their own land and adjacent sea areas. A unit price of 25 cents per square km per year is suggested as a reasonable fee which would provide economic viability to a well defined satellite system such as the Mapsat defined by the U.S. Geological Survey. This concept and pricing involve only the satellite and its data acquisition and transmission capability. Data reception, processing and distribution would remain a separate function to be implemented on a local or regional basis as is now done. Author

A84-46462

EARTH OBSERVATION FROM SPACE - HOW CLOUDED IS THE LONG LOOK DOWN?

C. BULLOCH Interavia (ISSN 0020-5168), vol. 49, Aug. 1984, p. 751-754.

Although U.S. administrations have encouraged the turn over of some space activities to the private business sector, certain systems will remain under government agency control, such as the American Metsat system which will continue to operate under the direction of NOAA. In the area of remote sensing, several private U.S. companies have offered to take over, operate and further develop the existing Landsat system which includes the failing Landsat 4 and 5 satellites. Remote sensing of territories has been generally welcomed by third world countries and the Soviet Union. However, at the United Nations' UNISPACE 82 conference, many developing nations have expressed their desire for such an operation to be conducted only upon their request. The establishment of new laws concerning the availability of remote sensing data to interests other than paying clients, foreign regulatory problems faced by companies such as SPARX, and the commercial and non-discriminatory distribution of SPOT data, are discussed. J.P.

A84-46544

THE ECONOMICS OF MAPPING WITH SPACE DATA

F. J. DOYLE (U.S. Geological Survey, Reston, VA) ITC Journal (ISSN 0303-2434), no. 1, 1984, p. 1-9.

Some of the costs and benefits of space mapping programs are discussed. Consideration is given to four general areas where costs are incurred in space mapping programs: data acquisition; data processing and dissemination; ground control and field work; and cartography and printing. The data acquisition costs are shown to be the highest because they include the design and launch of new spacecraft and sensors, the cost of operating photographic mapping satellites in orbit and the costs of recovering data. Specific emphasis is given to the direct dollar costs incurred during several recent space mapping missions: Landsat 4, the Modular Payload Support Structure for the Large Format Camera (LFC), the Shuttle Pallet Satellite (SPS), Landsat 5, Ariane, Conestoga II, and Leasecraft. In order to illustrate how high costs are incurred, a sample space mapping system is considered which produced an annotated image map of the U.S. for 69 million dollars per square km. It is argued that such costs are acceptable because of the

great advantages space mapping presents over conventional survey/mapping methods. I.H.

A84-47677

REMOTE SENSING - THE NEXT 50 YEARS

M. R. HOLTER (Michigan, Environmental Research Institute, Ann Arbor, MI) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-20, July 1984, p. 316-324.

Remote sensing is viewed as a complete system for observing and managing man's environment on earth. The sensing portion of the system consists of space, air, and ground observing platforms, sensors, communications, computational capabilities and interpretation, and recognition algorithms. The data are put to use using environmental models, geographic information systems, and management models. Progress and potentials in each of these system elements are reviewed and projected. Existing and potential uses are sketched and certain institutional, diplomatic, and national security issues are identified. Some underlying reasons for belief in continued progress are mentioned and the need for certain crucial choices in the future stated which will determine which of a number of possible futures will be realized. Author

A84-47678#

NOAA SATELLITE PROGRAMS

E. S. EPSTEIN, W. M. CALLICOTT, D. J. COTTER, and H. W. YATES (NOAA, Washington, DC) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-20, July 1984, p. 325-344.

A description is given of current National Oceanic and Atmospheric Administration (NOAA) programs involving Landsat as well as the Metsat polar-orbiting and geostationary satellites. These include the use of NOAA satellites as data collection platforms and the use of NOAA satellite radiometers in monitoring meteorologic, oceanographic, hydrologic, and agricultural phenomena. Configuration of the next generation of NOAA satellite sensors and spacecraft is included along with a final section on research directions and results. Author

A84-47679

FUTURE COMMERCIAL DIRECTIONS IN ENVIRONMENTAL REMOTE SENSING FROM SPACE

R. F. BRAMMER (Analytic Sciences Corp., Reading, MA) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-20, July 1984, p. 345-362. refs

It is pointed out that for nearly 25 years environmental satellite remote sensing has been an important application of aerospace electronic technology. The present investigation is concerned with potential commercial applications of satellite remote sensing technology to the environmental fields of meteorology, oceanography, and hydrology. The roles of satellites in environmental remote sensing are discussed, taking into account aspects of orbit selection, instrumentation, and data processing algorithms. Technology trends are considered, giving attention to satellite sensor technology, computer and peripheral hardware, environmental physics, algorithm and software development, data communications technology, and a technology summary. Markets for environmental remote sensing data products are related to transportation, agriculture, commercial fishing, forestry, paper products, electrical utilities, and water resources management. G.R.

A84-49131*

SATELLITE LAND REMOTE SENSING ADVANCEMENTS FOR THE EIGHTIES; PROCEEDINGS OF THE EIGHTH PECORA SYMPOSIUM, SIOUX FALLS, SD, OCTOBER 4-7, 1983

Symposium sponsored by NASA, NOAA, and U.S. Geological Survey. Sioux Falls, SD, Augustana College, 1984, 389 p. For individual items see A84-49132 to A84-49157.

Among the topics discussed are NASA's land remote sensing plans for the 1980s, the evolution of Landsat 4 and the performance of its sensors, the Landsat 4 thematic mapper image processing system radiometric and geometric characteristics, data quality, image data radiometric analysis and spectral/stratigraphic analysis,

and thematic mapper agricultural, forest resource and geological applications. Also covered are geologic applications of side-looking airborne radar, digital image processing, the large format camera, the RADARSAT program, the SPOT 1 system's program status, distribution plans, and simulation program, Space Shuttle multispectral linear array studies of the optical and biological properties of terrestrial land cover, orbital surveys of solar-stimulated luminescence, the Space Shuttle imaging radar research facility, and Space Shuttle-based polar ice sounding altimetry. O.C.

A84-49132#

NASA'S LAND REMOTE SENSING PLANS FOR THE 1980'S

D. G. MCCONNELL IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 2-26. refs

Great interest is noted in the study of global temperatures over time in order to detect indications of global warming due to the accumulation of CO₂, as well as to better understand the global cycles of the nutrient chemicals carbon, nitrogen, sulphur, and phosphorous. Accurate, quantitative, continental-scale vegetation maps could provide a measurement of the vegetated land area on which predictions of biological productivity and chemical uptake could be made. The NASA Advanced Very High Resolution Radiometer is under development to furnish such data. The related Global Habitability Concept is a long term NASA commitment to investigation of the biological, physical, and chemical processes underlying changes in the earth's land/ocean/atmosphere system and to assess the impact of system changes. O.C.

A84-49145#

NEW OPPORTUNITIES FOR THE PRIVATE SECTOR IN SPACE TECHNOLOGY

W. D. CARTER and A. B. PARK (Globex, Inc., Reston, VA) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 217-225. refs

The proposed transfer of the Landsat operational system to the private sector is certain to create many new opportunities, and a few problems, for those entrepreneurs willing to invest in the future of this program. While there is vigorous conflict of opinions over the worth of the program, we believe the assets of the program are unique in several respects. First, no other resource of the federal government can acquire the same objective information about the natural resources of the earth. Second, the revenue potential of the sale of the data is orders of magnitude smaller than the revenue potential of resource investment decisions enabled by early access to the raw data. Third, we find it ironic that because the system was designed and administered jointly by and for the resource agencies of the government, it has become an albatross around the neck of the single 'responsible' agency. If logic were used as a criterion, the program was a model of how to conduct cost-effective research in the government. This paper discusses alternative strategies and opportunities for private sector involvement. Author

A84-49153#

SPOT SIMULATION PROGRAMME

J. C. CAZAUX (Groupeement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 307-327.

The series of technical studies undertaken to simulate the performance of the French SPOT terrestrial remote-sensing satellite during the period 1979-1983 is surveyed. The geometric parameters of SPOT (orbital location, satellite attitude, HRV-instrument geometry, earth rotation and sphericity, ground relief, projection, and stereoscopy) and the radiometric parameters (spectral bands, boresight directions, local time, and orbit inclination) are simulated

separately by processing aerial photographs at scales from 1:30,000 to 1:110,000 and resolution 10 or 20 m. The individual studies of the series, the sponsoring organizations, and the countries in which the studies were performed are listed in tables, and simulations of typical applications to cartography, urban planning, coastal studies, land use studies, crop statistics, and geology are briefly characterized. T.K.

A84-49157*# National Aeronautics and Space Administration, Washington, D. C.

INTEGRATED REMOTE SENSING OF THE EARTH FROM LOW EARTH ORBIT IN THE 1990'S

D. M. BUTLER (NASA, Washington, DC) IN: Satellite land remote sensing advancements for the eighties; Proceedings of the Eighth Pecora Symposium, Sioux Falls, SD, October 4-7, 1983. Sioux Falls, SD, Augustana College, 1984, p. 368-375.

Trends in the areas of science, data systems, instruments and space technologies and their related infrastructures that will be experienced in earth remote sensing activities from LEO in the 1990s are discussed. Interdisciplinary studies will examine the flow of energy through the earth system, encompassing surveys of atmospheric and ocean circulations, the hydrologic cycle, and biogeochemical cycles. Mainframe computer assimilation of large data inputs will be associated with distributed microcomputer processing and analyses. Single satellite antennas will scan several microwave frequencies simultaneously, e.g., taking data on vegetation, water, and ice. Broadening the range of simultaneous observations will require multiinstrumented free-flying platforms, placed in orbit, repaired and/or retrieved by the Shuttle. Future instrumentation will include visible/IR imagers and the multifrequency microwave sounders with capabilities mainly limited by the availability of sufficient data-handling facilities. M.S.K.

N84-28867# Joint Publications Research Service, Arlington, Va. RESULTS FROM STUDY OF EARTH RESOURCES FROM SPACE

L. ZLOBIN and Y. KELNER In its USSR Rept.: Space (JPRS-USP-84-003) p 98-100 14 Jun. 1984 Transl. into ENGLISH from Pravda (USSR), 12 Sep. 1983 p 3 Avail: NTIS HC A07

A general discussion of the remote sensing of Earth Resources is given. The economic importance of remote sensing, resource management, satellite-borne photography, mapping, and photointerpretation are discussed. R.J.F.

N84-30360*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

THE LANDSAT-4 PROGRAM: AN OVERVIEW

W. WEBB In its LANDSAT-4 Sci. Invest. Summ., Including Dec. 1983 Workshop Results, Vol. 1 p 1-14 Jul. 1984 ERTS Avail: NTIS HC A10/MF A01 CSCL 05A

LANDSAT 4 was launched on July 22, 1982. This is the first satellite to carry the high resolution, high data rate Thematic Mapper (TM). An overview of the LANDSAT 4 Program is presented in terms of the program plan, accomplishments and future events, the transition of operational responsibility to National Oceanic and Atmospheric Administration (NOAA) management and the challenges remaining to both NASA personnel and LANDSAT 4 Investigations Program participants. M.A.C.

N84-30450*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

EARTH OBSERVING SYSTEM. SCIENCE AND MISSION REQUIREMENTS, VOLUME 1, PART 1

Washington Aug. 1984 59 p Original contains color illustrations

(NASA-TM-86129-VOL-1-PT-1; NAS 1.15:86129-VOL-1-PT-1)

Avail: NTIS HC A04/MF A01 CSCL 12B

The Earth Observing System (EOS) is a planned NASA program, which will carry the multidisciplinary Earth science studies employing a variety of remote sensing techniques in the 1990's, as a prime mission, using the Space Station polar platform. The scientific rationale, recommended observational needs, the broad

system configuration and a recommended implementation strategy to achieve the stated mission goals are provided.

N84-30451*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH OBSERVING SYSTEM, INTRODUCTION

In its Earth Observing System. Sci. and Mission Requirements, Vol. 1, Part 1 p 1-11 Aug. 1983

Avail: NTIS HC A04/MF A01 CSCL 12B

Much is known about the Earth, but the unifying concepts are still only beginning to be established. An exposition of the key issues in Earth science is neither simple or concise. From the scientific questions at hand there are many interconnections among them and the view of the Earth as a system is essential to their solution. The Earth science goals for the 1990's are presented for the following areas: hydrologic cycle; biogeochemical cycles; climatological processes; geophysical processes; oceanography; and solid earth. B.G.

N84-31063# Committee on Science and Technology (U. S. House).

LAND REMOTE-SENSING COMMERCIALIZATION ACT OF 1984

Washington GPO 1984 47 p Rept. to accompany H. R. 5155 presented by the Comm. on Sci. and Technol. to the 98th Congr., 2nd Sess., 3 Apr. 1984 (H-REPT-98-647; GPO-31-006) Avail: US Capitol, House Document Room

A bill from the House Committee on Science and Technology on the provision to establish a system to promote the commercialization of land remote sensing satellite data is presented. The bill proposes to provide for the phased commercialization of land remote sensing data, to establish a clear framework of national security and international policy requirements within which private remote sensing space systems operate, to provide for the archiving of a basic set of land remote sensing data that will serve the public interest for global environmental monitoring, to designate the Department of Commerce as the lead agency for transferring space remote sensing to the private sector, and to prohibit the commercialization of meteorological satellites. A cost estimate from the Congressional Budget Office is included. E.R.

N84-31270*# National Academy of Sciences - National Research Council, Washington, D. C. Space Applications Board.

PRACTICAL APPLICATIONS OF A SPACE STATION

1984 104 p refs

(Contract NSR-09-012-106)

(NASA-CR-173672; NAS 1.26:173672; PB84-194794) Avail:

NTIS HC A06/MF A01 CSCL 22B

The potential uses of a special station for civil and commercial applications is examined. Five panels of experts representing user-oriented communities, and a sixth panel which dealt with system design considerations, based their studies on the assumption that the station would be a large platform, capable of housing a wide array of diverse instruments, and could be either manned or unmanned. The Earth's Resources Panel dealt with applications of remote sensing for resource assessment. The Earth's Environment Panel dealt with the Earth's atmosphere and its impact on society. The Ocean Operations Panel looked at both science and applications. The Satellite Communications Panel assessed the potential role of a space station in the evolution of commercial telecommunication services up to the year 2000. The Materials Science and Engineering panel focused on the utility of a space station environment for materials processing.

Author (GRA)

N84-32408# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data, and Information Service.

SATELLITE ACTIVITIES OF NOAA, 1983

Jul. 1984 22 p

Avail: NTIS HC A02/MF A01

Some services and uses, both national and international, are given. Satellite data are used to assess the impact of natural factors and human activities on global food and fuel supplies and on environmental quality. The data also are used to observe and forecast weather conditions, issue warnings of severe weather, and assist community preparedness programs for weather related disasters; to prepare charts and coastal maps and for geodetic research; to improve assessment and conservation of marine life; to meet the needs of public and private users, including scientists; and for research to improve the nation's environmental service. NOAA agencies that participate directly in aeronautics and space programs are: the National Environmental Satellite, Data and Information Service, the National Weather Service, the National Ocean Service, the National Marine Fisheries Service, and the Office of Oceanic and Atmospheric Research. E.R.

N84-33364*# National Aeronautics and Space Administration, Washington, D. C.

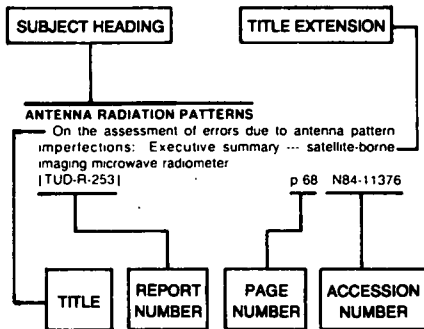
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1983 ACTIVITIES

1984 101 p

(NASA-TM-85538; NAS 1.15:85538) Avail: NTIS HC A06/MF A01 CSCL 05A

Achievements in communication; space science; space transportation; aeronautics; and Earth resources and environment are summarized. Activities of the various Federal agencies and cooperation with NASA in these areas are described. The Presidential policy announcement on the endorsement of commercial operation of expendable launch vehicles is included. Tables show, the space activities budget; a historical budget summary, U.S. space launch vehicles; U.S. and Soviet manned spaceflights, 1961 to 1983; U.S. launched space probes, 1975 to 1983; U.S. launched scientific and applications satellites, 1978 to 1983; the U.S. spacecraft record; the world record of space launches successful in attaining Earth orbit or beyond; and successful U.S. launchings for 1983. A.R.H.

Typical Subject Index Listing



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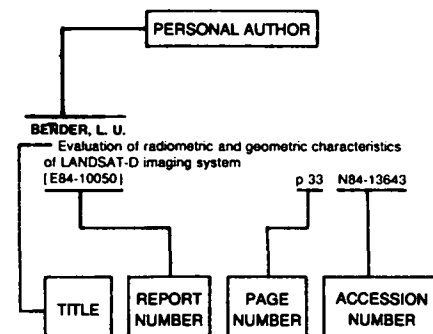
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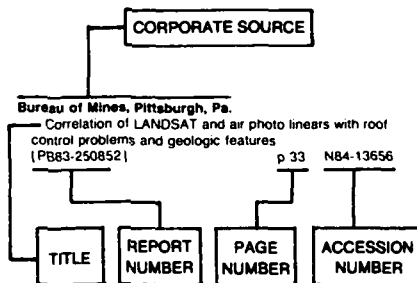
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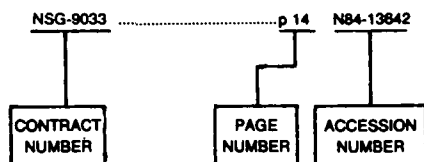
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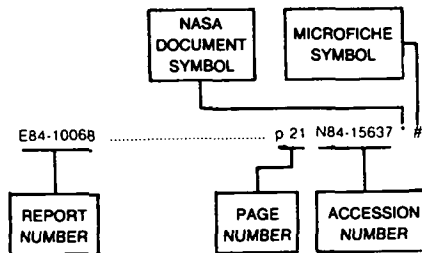
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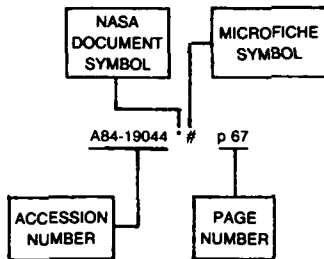
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